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Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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Dec 1, 2014

Ms. Gina McCarthy
Administrator
U.S. Environmental Protection Agency
EPA Docket Center—Mail Code 2822T
1200 Pennsylvania Ave., NW
Washington, D.C. 20460

Attn: Docket ID No. EPA-HQ-OAR-2013-0602

Re: Comments on proposed Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; 79 Fed. Reg. 34830 (June 18, 2014)

Dear Administrator McCarthy:

The House Committee on Science, Space and Technology[1] submits the following comments in response to the Environmental Protection Agency's (EPA) proposed Emission Guidelines for Greenhouse Gas Emissions from Existing Stationary Sources: Electric Utility Generating Units (CPP).

This proposal is outrageous. It doesn't take a detailed analysis to understand that this proposal regulates beyond the authorities Congress delegated. The CPP violates the letter and spirit of the Clean Air Act (CAA). No amount of administrative deference can rectify this fundamental flaw.

The extraordinary powers the EPA pretends to wield are invented out of whole cloth. To suggest that the CAA gives the federal government the right to regulate the daily lives of citizens within their homes is preposterous. Either the Agency has not read the CAA or assumes the law does not apply. If on the other hand, the EPA hopes to blackmail states into doing this dirty work for them, it is no better.

Congress has not given the EPA the authority to re-write laws or discover new powers for the sake of expediency. This proposal mocks our constitutional framework and subverts the rule of law. The brazen arrogance with which this Administration is steamrolling through such an arbitrary and capricious regulation is a breathtaking affront to the American people.

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[1] The Science Committee has jurisdiction over the core technical and scientific issues underpinning this rulemaking. The Committee's authority includes: all energy research, development and demonstration; environmental research and development; and, the commercial application of energy technology. House Rule X(1)(p).

Beyond the obvious legal deficiencies with this proposal, the crude technical assessments are shockingly amateur. A proposal of this nature and scope cannot afford to rely on anemic analysis, outlandish assumptions and makeshift modeling. It's embarrassing.

EPA's sweeping mandate requires a fundamental restructuring of our nation's energy system; it transforms how electricity is both produced and used. The broad new authority EPA claims raises critical questions about our ability to meet demand for reliable, affordable electricity.

If implemented in the current form, the CPP will impact the reliability and diversity of the nation's electricity supply. This could dramatically destabilize electricity prices and energy security. Perhaps most strikingly, the EPA proposal does next to nothing to impact changes in the global climate.

EPA must abandon this disastrous proposal. It would be a foolish waste of taxpayer resources to press ahead. This proposal will only result in years of costly legal wrangling. We have already spent too much time on a bad idea. Scrap this proposal and come up with something workable.

I. Overview

Consistent with its jurisdictional responsibilities, the Science Committee has conducted hearings to obtain testimony from leading technical, scientific, and policy experts. Further, the Committee monitored interactions between the EPA and the independent Science Advisory Board (SAB) charged with advising the Agency and Congress. Science Committee efforts uncovered serious problems and unanswered questions with the scientific and technical assumptions supporting EPA's CPP.

The goal of these comments is to provide the EPA with critical information obtained by the Committee in exercising its jurisdictional responsibilities. All regulations must have a sound technical and scientific basis. As the Agency has stated on many occasions, "science is, and continues to be the backbone of this agency and the integrity of our science is central to the identity and credibility of our work."[2] This Committee intends to hold EPA to that standard.

The Science Committee's comments highlight questions related to the technical, scientific and policy underpinnings of the CPP. This includes testimony obtained by the Science Committee and unanswered official Science Committee questions and oversight inquiries. Until these deficiencies are addressed, adequate peer review is undertaken, and the law is honored, the Agency stands in default.

II. Inadequate Peer Review

Under the law, the advice of scientific experts is a pre-requisite, not an afterthought. Specifically, the Environmental Research, Development, and Demonstration Authorization Act of 1978 (ERDDAA)[3] establishes the Science Advisory Board as an independent body charged

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[2] EPA News Release, "EPA Appoints New Scientific Integrity Official," Nov. 25, 2013, *available at* http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/d6741453e168fd4385257c2e00650858!OpenDocument.

[3] Environmental Research, Development and Demonstration Authorization Act of 1978, 42 USC § 4365.

with providing advice to Congress and the EPA. Under ERDDAA, the "Administrator, at the time any proposed criteria document, standard, limitation, or regulation under the... [CAA]... is provided to any other Federal agency for formal review and comment, shall make available to the Board such proposed criteria document, standard, limitation, or regulation, together with relevant scientific and technical information in the possession of the Environmental Protection Agency on which the proposed action is based."[4] Significantly, the law explains that this process provides the Board with a critical opportunity to share with the Administrator "its advice and comments on the adequacy of the scientific and technical basis of the proposed criteria document, standard, limitation, or regulation."[5] When followed, ERDDAA helps ensure that regulations are informed by sound science before they are ever proposed.

Further, EPA senior leadership and the SAB continue to note that waiting until the proposal stage to provide information to the SAB is too late in the process for meaningful input.[6] For this very reason, EPA created a new process to ensure that the SAB received planned Agency actions at the pre-proposal stage so that EPA could consider the Board's advice before proposing regulations.[7] It is clear from the statute and the Agency's own protocol that the Board should review the scientific underpinnings of draft proposals as part of the interagency process before a rule is ever proposed.

The Committee is concerned that the Agency failed to provide the SAB with an adequate opportunity to review the underlying science and provide independent advice before publishing the proposal. In particular, the only opportunity for review was during the fall of 2013 when considering the EPA's Spring 2013 Regulatory Agenda. This was before the EPA began its "unprecedented outreach" that shaped the CPP and months before scientific information relied upon in the CPP was published. It appears that the Agency issued the CPP absent the opportunity for meaningful examination required by the language and spirit of ERDDAA.

Given the suspicious timeline, the Committee asked Administrator McCarthy for documentation of communications with the Board. These inquiries were made in official Questions for the Record (QFRs) following a full Committee hearing in November of 2013. The EPA did not respond for over nine months. Not only was Agency's reply long over-due, but the responses were shamelessly evasive.

Specifically, in the September 2014, response to the Committee's December 2013, questions Administrator McCarthy wrote that "the appropriate protocol is to make such a request through a separate letter to the agency." It is hard to understand how it took the EPA nearly a year to formulate this simple response. Furthermore, the need for an additional and separate request letter is perplexing. One can only conclude that this charade was a deliberate attempt to stall Congressional oversight.

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[4] *Id.*

[5] *Id.*

[6] *See* Memorandum from SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science to Members of the Chartered SAB and SAB Liaisons, Nov. 12, 2013, *available at* http://yosemite.epa.gov/sab/sabproduct.nsf/18B19D36D88DDA1685257C220067A3EE/$File/SAB+Wk+GRP+Memo+Spring+2013+Reg+Rev+131213.pdf.

[7] A November 12, 2013 memo from the Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science to the Members of the Chartered SAB provides a detailed explanation of this process, its history, and the underlying legal obligations of ERDDAA.

On November 13, 2014, the Committee again requested records pertaining to the role the SAB played in providing advice on the CPP. Additionally, the Committee requested records of peer review of scientific and technical information the CPP relies on and publication of this information in the official docket.

The EPA has failed to respond to the Committee's requests.

Important documents referenced in this summary of communications are included as **Attachment A** as part of the Committee's comments on this rulemaking. These documents highlight significant procedural deficiencies in this rulemaking process.

III. Evidence Submitted to the Committee

Over the past few months, the Committee has held several hearings focusing on the technical and scientific issues underpinning this proposal. In these hearings, evidence was provided to the Committee through prepared testimony, oral testimony, and witness responses to questions for the record. These materials are included as **Attachment B** as part of the Committee's comments on this rulemaking.

In reference to the evidence provided in **Attachment B,** if the Agency disagrees with any of the testimony provided, please detail any objections. Please also detail the steps the Agency has taken to consider this evidence.

IV. Unanswered Questions for the Record

The Science Committee appreciates testimony provided during hearings. However, to fully understand and meaningfully consider the evidence witnesses convey, Committee members have an opportunity to ask official QFRs. The testimony witnesses provide in response to official questions is ultimately a part of the hearing and the official Congressional Record.

The Committee hearings can only be submitted in final publication format when witnesses respond to official QFRs in a timely manner. Unfortunately, EPA Assistant Administrator for Air and Radiation, Janet McCabe has failed to respond to the Committee's QFRs from her appearance before the Science Committee in September of 2014. Consequently, the Committee was forced to include the evidence obtained in a pre-publication format in **Attachment C** as a part of these Science Committee comments.

Again, in order to properly fulfill oversight responsibilities, the Science Committee needs honest and timely responses. It's a waste of taxpayer resources when several months or more pass between when a question is asked and when the answer is communicated. The hearing materials, transcripts, and unanswered QFRs address issues directly related to this rulemaking. To finalize a rule without fully addressing these issues would be arbitrary, capricious, and an abuse of discretion.

V. Technical Considerations Ignored

Committee investigations have uncovered important technical considerations ignored by the Agency when determining the "best system of emission reduction" (BSER). These unexplained assumptions have direct bearing on the determinations EPA makes in this proposal. We cannot afford to compromise transparency and accountability in the name of expediency. Accordingly, EPA should not move forward with a final rule until these questions are fully answered. The Agency's thorough responses should be made available for consideration as part of the official rulemaking record and public comment.

Reflecting upon the evidence obtained by the Science Committee and all other relevant information the Agency is aware of or has relied on, please respond to the questions in **Attachment D** and detail how such responses were considered in this rulemaking. To finalize a rule without fully addressing these issues would be arbitrary, capricious, and an abuse of discretion.

VI. Shoddy Compliance Modeling

The American people deserve the facts. This is impossible without a comprehensive, real-world analysis of the EPA's proposed regulations. Systematic biases and major omissions in EPA's limited evaluation produced a cost-benefit analysis divorced from reality. Its modeling suffers from a number of deficiencies that mask the rule's implications and limit its usefulness as a policy tool. Consequently, EPA's Regulatory Impact Assessment fails to assess whether the proposed rule will achieve meaningful benefits and, more importantly, whether the benefits are worth the heavy cost.

Similar to the unanswered requests for SAB communications, QFRs, and technical assumptions referenced above, the EPA has failed to adequately consider the impacts of the CPP. Consequently, the public has been deprived of adequate notice and an opportunity for meaningful comment.

Reassurances of "flexibility" are inadequate when considering regulations of this magnitude. Americans deserve an opportunity to see the facts. Without public access to all underlying assumptions, modeling mechanisms, and results, it is impossible to know whether the Agency has corrected core deficiencies that have resulted in the gross underestimation of impacts in previous rules.[8] Americans cannot afford to pay for EPA's mistakes.

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[8] Flaws in recent EPA analyses amplify concerns about the real impacts of these regulations. The Government Accountability Office released a report highlighting a pattern of shoddy EPA analysis. It was revealed that EPA relied on decades old data and ignored important factors. The independent watchdog warned that "EPA cannot ensure that it's [analysis] provide the public with a clear understanding of its decision making." For example, EPA claimed that the Mercury and Air Toxics Standards (MATS) would retire just 4.7 gigawatts of power. Yet, the Energy Information Administration (EIA) now projects that 54 gigawatts of generating capacity, ten times more than EPA's projections, will close by the MATS compliance deadline. EPA also said that MATS would increase electricity rates by just 1.3% to 6.3%. However, reports indicate that rate-payers are facing a 21% increase in rates this summer due to MATS power plant closures. Further, EPA assured Americans that MATS would not result in reliability concerns, but Midwest grid operators now warn of an impending electricity shortage. EPA's failure to adequately model MATS impacts is all the more troubling in light of the fact that EPA itself now models up to 49

EPA's incomplete modeling disregards a number of technical, regulatory, and economic realities.[9] These omissions have the effect of downplaying the possible energy and economic impacts of this proposal while simultaneously ignoring the lack of climate benefits. The costs of any greenhouse gas policies are directly proportional to the price and availability of viable technologies. In the case of base load power, these options include carbon capture and storage (CCS), natural gas, nuclear, and hydro-electric in some locations. In its analysis, the EPA assumes that these technologies are available and relatively affordable throughout the lifetime of the policy and beyond. But the facts paint a different picture.

For example, notwithstanding the Administration's claim that CCS is "adequately demonstrated," serious questions remain about its technological and economic viability beyond unique applications. At the same time, the EPA is poised to choke off the only economically viable CCS option, enhanced oil recovery, by putting in place regulations that would preclude its use as a carbon abatement option.[10] Furthermore, EPA has refused to recognize the use of other carbon utilization technologies for compliance purposes.[11] There is no evidence that EPA's modeling has taken these considerations into account.

In addition to issues related to the use of coal, concern about climate change has reinforced opposition in some quarters against other types of energy production. In the case of natural gas, continued access at today's historically low prices is questionable in the face of special-interest opposition to drilling and the specter of additional federal regulations. Further, EPA's sweeping assumption that natural gas plants can increase annual utilization to 70% across the entire fleet, presents huge technological challenges both at the plants and within the supply chain. EPA's proposal admits that 70% utilization rates have been exceptionally rare;[12] consequently, assertions of technical feasibility require detailed modeling, contingency planning, and real-world testing. There is no evidence that EPA's modeling has taken many of these and other confounding factors into account.

Over the past decade, there has been a renewed interest in nuclear power as an alternative to fossil fuels. Yet despite greater acceptance of this emissions-free energy resource, nuclear power faces a host of obstacles and uncertainties that could not only inhibit its expansion, but

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gigawatts of plant closures due to the proposed section 111 regulations. If past performance is an indication, could this number double, triple, or worse? GAO, *EPA Should Improve Adherence to Guidance for Selected Elements of Regulatory Impact Analysis*, at 32 July 2014. *Available at* http://oversight.house.gov/wp-content/uploads/2014/08/GAOreport.pdf.

[9] This proposal will have ripple effects throughout the wider economy as higher electricity and natural gas prices create drag on other sectors. No rule should proceed absent peer-reviewed economy-wide modeling. However, EPA has not attempted to model these impacts but is establishing a "Science Advisory Board panel on economy-wide modeling to consider the technical merits and challenges of using this analytical tool to evaluate costs, benefits, and economic impacts in regulatory development." RIA at 5-2.

[10] *See generally* Letter from U.S. House of Representatives Committee on Science, Space, and Technology to EPA Administrator Gina McCarthy, Dec. 19, 2013. *Available at* http://science.house.gov/sites/republicans.science.house.gov/files/documents/Letters/121913_mccarthy.pdf.

[11] Amanda Peterka, *Algae Companies Ask EPA to be able to Cash in on Power Plant Emissions*, GREENWIRE. Aug. 6, 2014.

[12] "The corresponding percentages of NGCC units that in 2012 operated at annual utilization rates of at least 65 percent and at least 75 percent were 16 percent and 6 percent, respectively." U.S. EPA, *Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, June 2, 2014, at Fn 127.

will accelerate retirements from the existing fleet. EPA's modeling fails to adequately consider the challenges facing our existing nuclear fleet.

The Agency also fails to consider significant legal problems with assumed compliance options. There is considerable uncertainty as to whether states will embrace EPA's proposal and implement it through a State Implementation Plan (SIP) like process. Consequently, if the Agency forcibly imposes a federal implementation plan on states, EPA's options may be limited to regulating the power plants themselves. Accordingly, an alternative policy analysis should assess the impact of the guidelines under a scenario limited to heat rate improvements and dispatch changes among affected power plants.

These fundamental technical constraints raise serious questions as to how this country could meet growing electricity demand affordably and reliably while complying with EPA's proposed CPP. Local, state, and regional level impacts must also be carefully considered. The effects of EPA's policies will vary dramatically and hinge on a wide variety of issues including everything from existing power resources and access to low cost alternatives to infrastructure constraints and energy demands. Americans deserve the bottom line: what does it cost and what will we get for the money?

Finally, EPA's failure to model impacts between 2030 and 2040 is a serious analytical shortcoming. The Administration has committed to reduce emissions by 83% by 2050. As a result, reductions beyond 2030 must be analyzed to understand the implications of this approach. Given the White House's promises in this regard, the target reduction for the power sector for 2040 should be modeled on a trajectory consistent with the implied 2050 target.

Credible analysis is critical to a well-informed debate concerning climate change and energy policy choices now before American people. As such, in August of 2014, the Science Committee requested that the EPA analyze the proposed guidelines taking these realities into account. Given the urgent nature of this request, the Committee supplied detailed specifications for assessment.

Unfortunately, the EPA responded a month later with little more than excuses. The September 2014, letter from the EPA demonstrated a misunderstanding of the Committee's modeling request. With the close of the comment period rapidly approaching, the Science Committee again reiterated the pressing need for comprehensive analysis in a November 2014, letter to the EPA. The Agency has failed to complete these pivotal assessments.

Important documents referenced in this summary of communications are included as **Attachment E** as part of the Committee's comments on this rulemaking. These documents and EPA's failure to consider real-world impacts, highlight significant procedural deficiencies in this rulemaking process. Accordingly, EPA should not move forward with a final rule until this modeling is undertaken and the results are made available for consideration as part of the official rulemaking record and public comment.

VII. Conclusion

We cannot afford to ignore inconvenient details when the truth hangs in the balance. Mindful of the unique role created for the Science Committee under the law and the Agency's commitment to scientific integrity, before moving ahead with this proposal the EPA must address the unanswered questions and problems highlighted in these comments.

The CPP proposal is premature, arbitrary, and inadequately supported by the record. For the reasons provided in these comments, the EPA must abandon this proposal.

Sincerely,

Rep. Lamar Smith

Chairman
Committee on Science,
Space, and Technology

cc: The Hon. Shaun Donovan, Director, Office of Management and Budget
Rep. Eddie Bernice Johnson, Ranking Member, Committee on Science, Space, and Technology

Attachment A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

OFFICE OF THE DMINISTRATOR
SCIENCE ADVISORY BOARD

MEMORANDUM

SUBJECT: Preparations for Chartered Science Advisory Board (SAB) December 4-5, 2013 Discussions of EPA Planned Agency Actions and their Supporting Science in the Spring 2013 Regulatory Agenda

DATE: November 12, 2013

FROM: James R. Mihelcic, Chair, SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

TO: Members of the Chartered SAB and SAB Liaisons

The Chartered SAB will discuss whether to review the adequacy of the science supporting planned regulatory actions announced in the Spring 2013 Regulatory Agenda at its December 4-5, 2013 meeting. An SAB Work Group was charged with identifying actions for consideration by the Chartered SAB. This memorandum provides background on this activity, a short description of the process for identifying actions for SAB consideration, a summary of the process used by the Work Group, and the Work Group's recommendations on the planned actions and improvements to the process.

Background

The Environmental Research, Development, and Demonstration Authorization Act of 1978 (ERDDAA) requires the EPA to make available to the SAB proposed criteria documents, standards, limitations, or regulations provided to any other Federal agency for formal review and comment, together with relevant scientific and technical information on which the proposed action is based. The SAB may then make available to the Administrator, within the time specified by the Administrator, its advice and comments on the adequacy of the scientific and technical basis of the proposed action.

In 2012, EPA senior leadership agreed on a process to provide the Board with information about planned agency actions in the pre-proposal stage, so that the agency could receive advice from the SAB in the regulatory process when SAB advice could be meaningful. EPA's current process is to provide the SAB with information about the publication of the semi-annual regulatory agenda and to provide short descriptions of major planned actions that are not yet proposed but appear in the semi-annual regulatory agenda (Attachment A). This process supplements the EPA's process for program and regional offices to identify scientific issues that might be appropriate for SAB consideration.

Summary of the process used by the SAB Work Group

The SAB Work Group followed the process established by the Agency and the process adopted by the Chartered SAB after completing its review of the Fall 2012 Unified (Regulatory) Agenda and Regulatory Plan (Attachment B). The current SAB review began when the EPA Office of Policy informed the SAB Staff Office that the Spring 2013 Unified (Regulatory) Agenda and Regulatory Plan had been published on July 3, 2013. This semi-annual regulatory agenda is available at http://www.reginfo.gov/public/.

An SAB Work Group was formed in August 2013 and consisted of SAB members with broad expertise in scientific and technological issues related to the proposed actions. The Work Group consisted of Drs. James R. Mihelcic (chair), Taylor Eighmy, R. William Field, H. Christopher Frey, Madhu Khanna, and Peter S. Thorne.

On August 15, 2013, the Work Group received short descriptions of the major planned actions that were not yet proposed and are listed in the July 3, 2013 semi-annual regulatory agenda. The Work Group held a planning work session via teleconference on September 4, 2013 to identify additional information needed to assist them in identifying priority actions for SAB advice and comment.

SAB Staff facilitated a fact finding teleconference as requested by the Work Group on September 26, 2013. The EPA Office of Air and Radiation and the Department of Energy's National Energy Technology Laboratory (NETL) staff provided additional information requested after the meeting. Attachment C provides a summary of the meeting and the additional information provided by EPA and NETL. The Work Group exchanged information via email and held a teleconference on November 4, 2013 to prepare the recommendations in this memorandum.

The Work Group considered actions in the July 2013 semi-annual regulatory agenda that were identified by the EPA as "major actions." The Work Group considered several factors when assessing each proposed major action, i.e., whether the action:

- already had a planned review by the SAB or some other high level external peer review [e.g., National Academy of Sciences, Clean Air Scientific Advisory Committee, Federal Insecticide, Fungicide and Rodenticide (FIFRA) Scientific Advisory Panel];
- was primarily administrative (i.e., involved reporting or record keeping);
- was an extension of an existing initiative;
- was characterized by EPA as an influential scientific or technical work product having a major impact, or involved precedential, novel, and/or controversial issues;
- considered scientific approaches new to the agency;
- addressed an area of substantial uncertainty;
- involved major environmental risks;
- related to an emerging environmental issue; or
- exhibited a long-term outlook.

Work Group Recommendations Regarding Planned EPA Actions of Interest to the SAB

Attachment D provides information on the 11 major actions considered by the Work Group. This attachment includes brief agency descriptions of the planned actions, the Work Group recommendations and supporting rationales.

Of the 11 major actions considered based on the information received from the EPA, the Work Group recommends that 2 actions merit SAB consideration.

- The SAB Work Group recommends that the SAB review the science supporting the Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generation Units (2060-AQ91). This proposed action was signed by Administrator McCarthy on September 20, 2013 and released to the public during the Work Group's deliberations. EPA stated that the science and technical bases of this action do not rely on new science, are based on the Best System of Emission Reduction, and the action is technology based. In contrast, the Work Group notes that this action involves precedential and novel issues that rely on new technologies and science for carbon capture and storage (CCS). EPA Staff explained that the CCS provisions would only be binding to coal fired EGUs and are based on three examples of implementing partial CCS. They stated that the strong demonstration these facilities make for the technology (See Attachment C) and this proposal relies on existing sequestration studies and reporting requirements for carbon capture. The Work Group finds that the scientific and technical basis for carbon storage provisions is new science and the rulemaking would benefit from additional review. The specific technical and scientific matters that can be examined as part of the discussion include the scientific basis to develop separate standards for new gas-fired and coal-fired units, carbon capture and storage as a Best System of Emission Reductions for coal-fired plants and underlying scientific assumptions around carbon pollution emissions technological controls.

  The EPA has stated that U.S. Department of Energy National Energy Technology Laboratory (NETL) studies[1] as well as existing EGUs under construction and in advanced stages of development were used as the basis for the BSER assumptions for new natural gas and coal fuel sources for new EGUs. EPA staff explained that the NETL studies were all peer reviewed and EPA did not conduct additional peer review(s). However, based on additional information provided to the Work Group from NETL, the peer review appears to be inadequate.

- The SAB workgroup recommends that SAB review the scientific and technical basis for the Revision of 40 CFR Part 192--Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In Situ Leaching Processing Facilities (2060-AP43) when details of the proposed rule are available. Although the SAB provided advice to the agency in

[1] Volume 1 of the series – "Cost and Performance Baseline for Fossil Energy Power Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity" (and subsequent updates) – available at http://www.netl.doe.gov/energy-analyses/baseline_studies.html
August 2011 report "Cost and Performance of PC and IGCC Plants for a Range of Carbon Dioxide Capture" which modified the CO2 capture rates for select cases presented in the "Cost and Performance Baseline for Fossil Energy Plants" did not undergo peer review. That report can be found here: http://www.netl.doe.gov/energy-analyses/refshelf/PubDetails.aspx?Action=View&PubId=396

2012 (*Advisory on EPA's draft Technical Report entitled Considerations Related to Post Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites* EPA-SAB-12-2005), this action is still under development and the Work Group could not determine from the limited information provided by the agency, the adequacy of the scientific and technical basis for this important planned action. The Work Group recommends that the SAB evaluate the proposed rule and at that time determine if commentary is appropriate to provide to the Administrator.

Table 1 summarizes the 11 planned actions by name and Regulation Identifier Number (RIN) and the Work Groups recommendations.

Table 1: Summary of Proposed Actions that the SAB Work Group considered for additional SAB Comment on the Supporting Science

RIN[1]	Planned Action Title	Workgroup recommendation
2060-AR76	Renewable Fuel 2014 Volume Standards	No further SAB consideration is merited
2060-AQ44	Review of the National Ambient Air Quality Standards for Lead	No further SAB consideration is merited. This action was reviewed by CASAC
2060-AP69	NESHAP: Brick and Structural Clay Products and Clay Products	No further SAB consideration is merited.
2060-AR28	PSD for Particulate Matter Less Than 2.5 Micrometers (PM2.5)—Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration: Reconsideration	No further SAB consideration is merited.
2060-AP26	National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart W: Standards for Radon Emissions From Operating Uranium Mill Tailings: Review	No further SAB consideration is merited.
2060-AP43	Revision of 40 CFR Part 192--Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In Situ Leaching Processing Facilities	The Work Group recommends that the Chartered SAB review this Action
2060-AQ48	Implementation Rule for 2012 PM2.5 NAAQS	No further SAB consideration is merited.
2060-AR33	Greenhouse Gas New Source Performance Standard for Electric Generating Units-Emission Guidelines for Existing Sources	No further SAB consideration is merited.
2060-AQ91	Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generation Units	The Work Group recommends that the Chartered SAB review this Action

Table 1: Summary of Proposed Actions that the SAB Work Group considered for additional SAB Comment on the Supporting Science

RIN[1]	Planned Action Title	Workgroup recommendation
2070-AJ22	Pesticides; Agricultural Worker Protection Standard Revisions	No further SAB consideration is merited. The FIFRA SAP waived its review of this proposed action.
2070-AJ38	Polychlorinated Biphenyls (PCBs); Reassessment of Use Authorizations	No further SAB consideration is merited.

1. The RIN (Regulation Identification Number) is a hyperlink to the semi-annual Regulatory Agenda Spring 2013 web page for each planned action.

Work Group Recommendations Regarding Improvements to the Process for Identifying EPA Planned Actions for SAB Consideration

The Work Group thanks the EPA for providing information for consideration but emphasizes that the SAB requires more complete and timely information from the agency to make recommendations and decisions regarding the science supporting planned actions. To improve the process for future review of the semi-annual regulatory agenda, the SAB Work Group strongly recommends that EPA enhance descriptions of future planned actions by providing specific information on the peer review associated with the science basis for actions and more description of the scientific and technological bases for the actions. In reviewing the Spring 2013 Regulatory Agenda, there were several cases where key information about the planned action, its supporting science and peer review were provided only after specific work group requests. EPA should provide such information in the initial descriptions provided to the work group.

Effective SAB evaluation of planned actions requires the agency to characterize:

- All relevant key information associated with the planned action;
- The science supporting the regulatory action. If there is new science to be used, provide a description of what is being developed. If the agency is relying on existing science, provide a short description.
- The nature of planned or completed peer review. To the extent possible, provide information about the type of peer review, the charge questions provided to the reviewers, how relevant peer review comments were integrated into the planned action, and information about the qualifications of the reviewer(s).

This SAB Work Group made several of these recommendations in March 2013. We request that the chartered SAB highlight to the Administrator the need for the Agency to provide more complete information to support future SAB decisions about the adequacy of the science supporting actions in future regulatory agendas.

Attachments

Attachment A: Implementation Process for Identifying EPA Planned Actions for SAB Consideration

Attachment B: Process for Chartered SAB Discussions of EPA Planned Actions and their Supporting Science

Attachment C: Summary of the September 26, 2013 fact-finding teleconference, questions sent to National Program Offices at the SAB Work Group's request and the agency responses.

Attachment D: Descriptions of Major EPA Planned Actions Identified in the July 2013 Semi-Annual Regulatory Agenda with SAB Work Group Recommendations.

Attachment A: Implementation Process for Identifying EPA Planned Actions for SAB Consideration

Background on the EPA Process

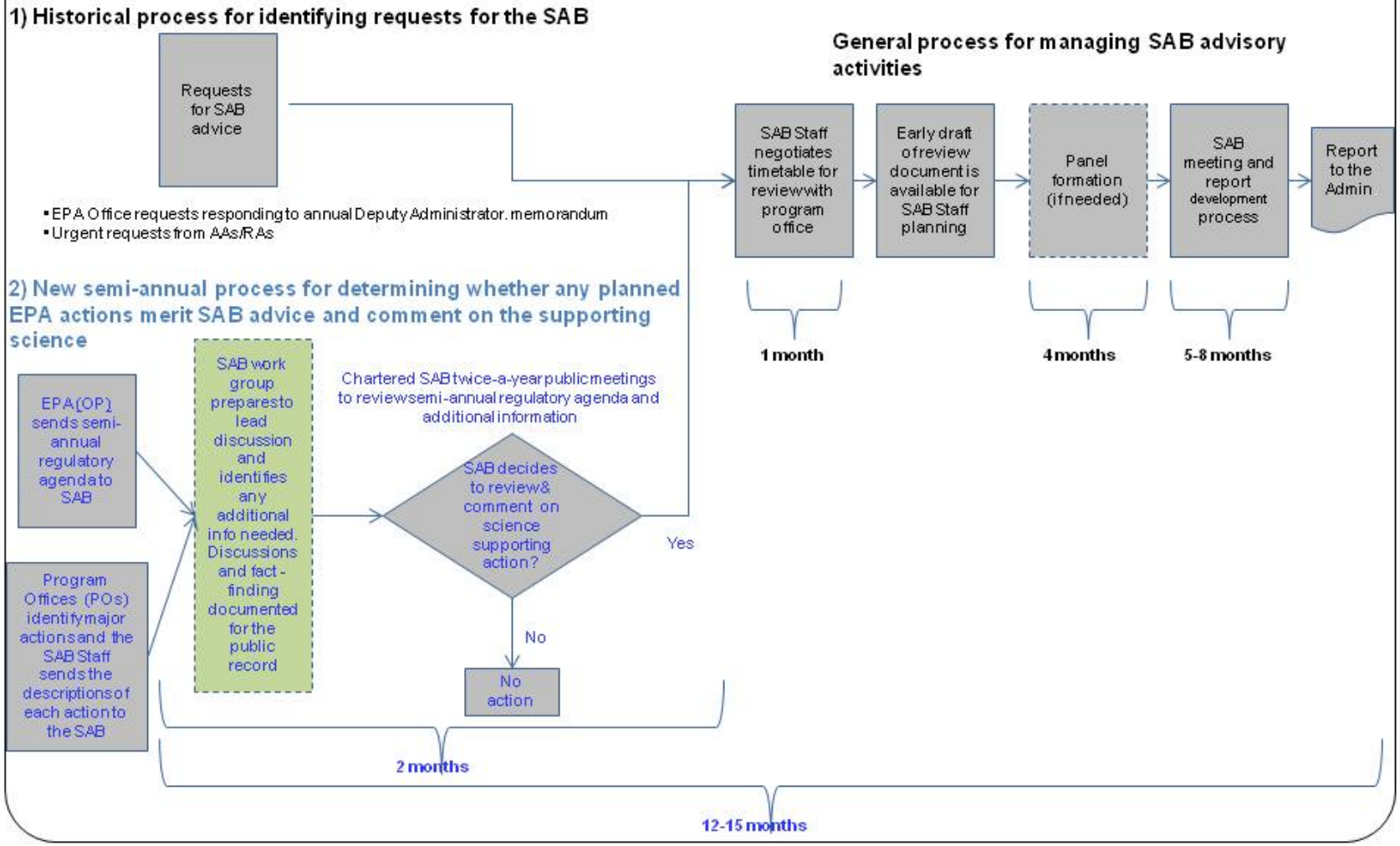
- The Environmental Research, Development, and Demonstration Authorization Act of 1978 (ERDDAA, see p. 4))
    - Requires the EPA to make available to the SAB proposed criteria documents, standards, limitations, or regulations provided to any other Federal agency for formal review and comment together with relevant scientific and technical information in the possession of the agency on which the proposed action is based.
    - States that the Board may make available to the Administrator, within the time specified by the Administrator, its advice and comments on the adequacy of the scientific and technical basis of the proposed actions.
- In January 2012, Office of Policy Associate Administrator Michael Goo issued a memorandum to strengthen coordination with the SAB by providing the Board with information about *proposed* agency actions.
- In February 2012, SAB Staff developed an initial proposal to provide the SAB with information about *proposed* agency actions.
    - EPA Senior Leadership concluded that providing information to the SAB for consideration at the proposal stage was *too late* in the process for meaningful involvement.
- In March 2012, the SAB held a public meeting and discussed the Goo memo and a pilot to consider the science underlying four proposed rules identified by OAR (standards for air toxics from boilers and incinerators and greenhouse gas emissions and fuel economy standards for light-duty vehicles).
    - The SAB:
        - Did not identify any science topics related to the four proposed rules warranting SAB comment.
        - Noted that the proposal stage was *too late* in the process for meaningful input.
        - Discussed the need for adequate information on the underlying science for agency actions early in the process. Information beyond the information presented in the Semiannual Regulatory Agenda is needed for this purpose.
- On December 27, 2012, Associate Administrator Michael Goo, the Administrator's Science Advisor Glenn Paulson, and the SAB Office Director Vanessa Vu issued a memorandum (see p. 10) "Identifying EPA Planned Actions for Science Advisory Board (SAB) Consideration of the Underlying Science – Semi-annual Process" requiring EPA to provide short descriptions of *major planned actions that are not yet proposed* appearing in the semi-annual regulatory agenda
- This process supplements the Deputy Administrator's annual memorandum requesting program and regional offices to identify scientific issues that might be appropriate for SAB consideration.

- On January 30, 2013, EPA Program Offices will provide short descriptions of the *major planned actions that are not yet proposed* that appeared in December 21, 2012 semi-annual regulatory agenda (available at http://www.reginfo.gov/public/).

Proposed SAB Process

- The chartered SAB will meet twice a year to review the semi-annual regulatory agenda and descriptions of major planned actions to determine if the SAB wishes to identify any actions for additional attention where the Board may wish to provide "advice and comments on the adequacy of the scientific and technical basis of the proposed actions."
    - Members of the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science will lead the discussion at the chartered SAB's meeting.
- The SAB Staff will facilitate any additional fact finding requested prior to the meeting and work with EPA to schedule and manage the SAB process for actions where the SAB would like to provide advice and comments.
- The SAB Staff will manage the new semi-annual process for determining whether any planned EPA actions merit SAB advice and comment on the supporting science as part of the entire SAB operating plan (see Figure 1).

Figure 1: Two Major Processes for Identifying Advisory Activities for the SAB Operating Plan:
1) the historical process for identifying requests and 2) the new semi-annual process for determining whether any planned EPA actions merit SAB advice and comment on the supporting science



Environmental Research, Development, and Demonstration Authorization Act [(ERDDAA), 42 U.S.C. 4365]

TITLE 42--THE PUBLIC HEALTH AND WELFARE

CHAPTER 55--NATIONAL ENVIRONMENTAL POLICY

SUBCHAPTER III--MISCELLANEOUS PROVISIONS

Sec. 4365. Science Advisory Board

(a) Establishment; requests for advice by Administrator of Environmental Protection Agency and Congressional committees

The Administrator of the Environmental Protection Agency shall establish a Science Advisory Board which shall provide such scientific advice as may be requested by the Administrator, the Committee on Environment and Public Works of the United States Senate, or the Committee on Science, Space, and Technology, on Energy and Commerce, or on Public Works and Transportation of the House of Representatives.

(b) Membership; Chairman; meetings; qualifications of members

Such Board shall be composed of at least nine members, one of whom shall be designated Chairman, and shall meet at such times and places as may be designated by the Chairman of the Board in consultation with the Administrator. Each member of the Board shall be qualified by education, training, and experience to evaluate scientific and technical information on matters referred to the Board under this section.

(c) Proposed environmental criteria document, standard, limitation, or regulation; functions respecting in conjunction with Administrator

(1) The Administrator, at the time any proposed criteria document, standard, limitation, or regulation under the Clean Air Act [42 U.S.C. 7401 et seq.], the Federal

Water Pollution Control Act [33 U.S.C. 1251 et seq.], the Resource Conservation and Recovery Act of 1976 [42 U.S.C. 6901 et seq.], the Noise Control Act [42 U.S.C. 4901 et seq.], the Toxic Substances Control Act [15 U.S.C. 2601 et seq.], or the Safe Drinking Water Act [42 U.S.C. 300f et seq.], or under any other authority of the Administrator, is provided to any other Federal agency for formal review and comment, shall make available to the Board such proposed criteria document, standard, limitation, or regulation, together with relevant scientific and technical information in the possession of the Environmental Protection Agency on which the proposed action is based.

(2) The Board may make available to the Administrator, within the time specified by the Administrator, its advice and comments on the adequacy of the scientific and technical basis of the proposed criteria document, standard, limitation, or regulation, together with any pertinent information in the Board's possession.

(d) Utilization of technical and scientific capabilities of Federal agencies and national environmental laboratories for determining adequacy of scientific and technical basis of proposed criteria document, etc.

In preparing such advice and comments, the Board shall avail itself of the technical and scientific capabilities of any Federal agency, including the Environmental Protection Agency and any national environmental laboratories.

(e) Member committees and investigative panels; establishment; chairmenship

The Board is authorized to constitute such member committees and investigative panels as the Administrator and the Board find necessary to carry out this section. Each such member committee or investigative panel shall be chaired by a member of the Board.

(f) Appointment and compensation of secretary and other personnel; compensation of members

(1) Upon the recommendation of the Board, the Administrator shall appoint a secretary, and such other employees as deemed necessary to exercise and fulfill the Board's powers and responsibilities. The compensation of all employees appointed under this paragraph shall be fixed in accordance with chapter 51 and subchapter III of chapter 53 of title 5.

(2) Members of the Board may be compensated at a rate to be fixed by the President but not in excess of the maximum rate of pay for grade GS-18, as provided in the General Schedule under section 5332 of title 5.

(g) Consultation and coordination with Scientific Advisory Panel

In carrying out the functions assigned by this section, the Board shall consult and coordinate its activities with the Scientific Advisory Panel established by the Administrator pursuant to section 136w(d) of title 7.

(Pub. L. 95-155, Sec. 8, Nov. 8, 1977, 91 Stat. 1260; Pub. L. 96-569, Sec. 3, Dec. 22, 1980, 94 Stat. 3337; Pub. L. 103-437, Sec. 15(o), Nov. 2, 1994, 108 Stat. 4593; Pub. L. 104-66, title II, Sec. 2021(k)(3), Dec. 21, 1995, 109 Stat. 728.)

References in Text

The Clean Air Act, referred to in subsec. (c)(1), is act July 14, 1955, ch. 360, 69 Stat. 322, as amended, which is classified generally to chapter 85 (Sec. 7401 et seq.) of this title. For complete classification of this Act to the Code, see Short Title note set out under section 7401 of this title and Tables.

The Federal Water Pollution Control Act, referred to in subsec. (c)(1), is act June 30, 1948, ch. 758, as amended generally by Pub. L. 92-500, Sec. 2, Oct. 18, 1972, 86 Stat. 816, which is classified generally to chapter 26 (Sec. 1251 et seq.) of Title 33, Navigation and Navigable Waters. For complete classification of this Act to the Code, see Short Title note set out under section 1251 of Title 33 and Tables.

The Resource Conservation and Recovery Act of 1976, referred to in subsec. (c)(1), is Pub. L. 94-580, Oct. 21, 1976, 90 Stat. 2796, as amended, which is classified

generally to chapter 82 (Sec. 6901 et seq.) of this title. For complete classification of this Act to the Code, see Short Title of 1976 Amendment note set out under section 6901 of this title and Tables.

The Noise Control Act, referred to in subsec. (c)(1), probably means the Noise Control Act of 1972, Pub. L. 92-574, Oct. 27, 1972, 86 Stat. 1234, as amended, which is classified principally to chapter 65 (Sec. 4901 et seq.) of this title. For complete classification of this Act to the Code, see Short Title note set out under section 4901 of this title and Tables.

The Toxic Substances Control Act, referred to in subsec. (c)(1), is Pub. L. 94-469, Oct. 11, 1976, 90 Stat. 2003, as amended, which is classified generally to chapter 53 (Sec. 2601 et seq.) of Title 15, Commerce and Trade. For complete classification of this Act to the Code, see Short Title note set out under section 2601 of Title 15 and Tables.

The Safe Drinking Water Act, referred to in subsec. (c)(1), is title XIV of act July 1, 1944, as added Dec. 16, 1974, Pub. L. 93-523, Sec. 2(a), 88 Stat. 1660, as amended, which is classified generally to subchapter XII (Sec. 300f et seq.) of chapter 6A of this title. For complete classification of this Act to the Code, see Short Title note set out under section 201 of this title and Tables.

Codification

Section was enacted as part of the Environmental Research, Development, and Demonstration Authorization Act of 1978, and not as part of the National Environmental Policy Act of 1969 which comprises this chapter.

Amendments

1995--Subsecs. (c) to (i). Pub. L. 104-66 redesignated subsecs. (e) to (i) as (c) to (g), respectively, and struck out former subsec. (c) which read as follows: ``In addition to providing scientific advice when requested by the Administrator under subsection (a) of this section, the Board shall review and comment on the Administration's five-year plan for environmental research, development, and demonstration provided for by section 4361 of this title and on each annual revision thereof. Such review and comment shall be transmitted to the Congress by the Administrator, together with his comments

thereon, at the time of the transmission to the Congress of the annual revision involved."

1994--Subsec. (a). Pub. L. 103-437, Sec. 15(o)(1), substituted ``Committee on Science, Space, and Technology, on Energy and Commerce, or on'' for ``Committees on Science and Technology, Interstate and Foreign Commerce, or''.

Subsec. (d). Pub. L. 103-437, Sec. 15(o)(2), struck out subsec. (d) which related to review and report to Administrator, President, and Congress on health effects research.

1980--Subsec. (a). Pub. L. 96-569 inserted provisions relating to requests by the enumerated Congressional committees.

Change of Name

Committee on Science, Space, and Technology of House of Representatives treated as referring to Committee on Science of House of Representatives by section 1(a) of Pub. L. 104-14, set out as a note preceding section 21 of Title 2, The Congress.

Committee on Energy and Commerce of House of Representatives treated as referring to Committee on Commerce of House of Representatives by section 1(a) of Pub. L. 104-14, set out as a note preceding section 21 of Title 2. Committee on Commerce of House of Representatives changed to Committee on Energy and Commerce of House of Representatives, and jurisdiction over matters relating to securities and exchanges and insurance generally transferred to Committee on Financial Services of House of Representatives by House Resolution No. 5, One Hundred Seventh Congress, Jan. 3, 2001.

Committee on Public Works and Transportation of House of Representatives treated as referring to Committee on Transportation and Infrastructure of House of Representatives by section 1(a) of Pub. L. 104-14, set out as a note preceding section 21 of Title 2.

Termination of Advisory Boards

Advisory boards established after Jan. 5, 1973, to terminate not later than the expiration of the 2-year period beginning on the date oftheir establishment, unless, in

the case of a board established by the President or an officer of the Federal Government, such board is renewed by appropriate action prior to the expiration of such 2-year period, or in the case of a board established by the Congress, its duration is

otherwise provided for by law. See sections 3(2) and 14 of Pub. L. 92-463, Oct. 6, 1972, 86 Stat. 770, 776, set out in the Appendix to Title 5, Government Organization and Employees.

References in Other Laws to GS-16, 17, or 18 Pay Rates

References in laws to the rates of pay for GS-16, 17, or 18, or to maximum rates of pay under the General Schedule, to be considered references to rates payable under specified sections of Title 5, Government Organization and Employees, see section 529 [title I, Sec. 101(c)(1)] of Pub. L. 101-509, set out in a note under section 5376

of Title 5.

Section Referred to in Other Sections

This section is referred to in title 7 section 136w; title 21

section 346a.

12/27/12 Goo/Paulson/Vu memo requiring Agency to provide the SAB with information - Includes sample of information EPA will provide

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

JAN 2 2013

OFFICE OF THE ADMINISTRATOR

MEMORANDUM

SUBJECT: Identifying EPA Planned Actions for Science Advisory Board (SAB) Consideration of the Underlying Science – Semi-annual Process

FROM: Michael Goo, Associate Administrator
Office of Policy

Glenn Paulson
Science Advisor

Vanessa Vu, Director
SAB Staff Office

TO: General Counsel
Assistant Administrators
Associate Administrators
Regional Administrators

The purpose of this memorandum is to provide guidance for implementing improved coordination with the SAB, the goal of the memorandum dated January 19, 2012 on that topic (Attachment A).

We ask that you work with the Office of Policy to provide the SAB Staff Office with information about the science supporting major planned agency actions (Tier 1 and Tier 2 actions) that are in the pre-proposal stage. The *2012 Unified (Regulatory) Agenda and Regulatory Plan* was published on December 21, 2012 on the Office of Management and Budget web site http://www.reginfo.gov/public/.

Please provide the SAB Staff Office (contact: Angela Nugent) by **January 30, 2013**, a brief description of each action along with its supporting science, following the format provided in Attachment B. Please ensure that these submissions to the SAB are consistent with information developed in the action development process.

This process supplements the Deputy Administrator's annual memorandum requesting program and regional offices to identify scientific issues that might be appropriate for SAB consideration.

We look forward to working with you on this new process to strengthen science supporting EPA's decisions. Please contact us or Caryn Muellerleile (202-564-2855) in the Office of Policy or Angela Nugent (202-564-2218) in the SAB Staff Office, should there be questions.

Attachments

cc: Administrator
Deputy Administrator
Chief of Staff
Deputy Chief of Staff

Attachment A: January 19, 2012 Memorandum from Michal L. Goo

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 19 2012

OFFICE OF POLICY

MEMORANDUM

SUBJECT: Coordination with the Science Advisory Board Regarding Proposed Criteria Documents, Standards, Limitations and Regulations

FROM: Michael L. Goo, Associate Administrator
Office of Policy

TO: Assistant Administrators
General Counsel
Chief of Staff
Associate Administrators
Regional Administrators

This is to confirm the procedures that we have discussed regarding coordination with the Science Advisory Board (SAB) on the science and technical information underlying the EPA's proposed criteria documents, standards, limitations and regulations.

In addition to the current process by which program offices identify actions on which they plan to seek advice from the SAB on scientific and technical issues, OP will semiannually inform the SAB, through the SAB Staff Office, of upcoming proposed actions. This process will focus on those proposed regulations, criteria documents, standards or limitations that undergo interagency review and will operate as follows:

1. OP will submit to the SAB staff office a list, based on the Agency's *Semiannual Regulatory Agenda* (*Regulatory Agenda*), augmented as necessary, of upcoming proposed regulations, criteria documents, standards or limitations that are expected to undergo interagency review. OP will work with program and regional offices to ensure that any actions not listed in the *Regulatory Agenda* that nevertheless are expected to be submitted for interagency review are included in this submission. For any of these additional actions, offices should provide a description similar to that provided for actions included in the *Regulatory Agenda*.

2. Program and Regional offices will notify the SAB staff office when proposed Agency actions that undergo interagency review become formally available for public review and comment. EPA programs are also expected to provide additional information as requested by the SAB Staff Office to facilitate the SAB's consideration of this information.

If the SAB decides to review and, as appropriate, comment on the scientific and technical basis for a proposed action, OP will work with the SAB Staff Office and the relevant program or regional office to establish the appropriate time frame for SAB review and comment.

Thank you for your assistance in adhering to this process. If you have any questions or concerns, please contact me, or your staff can contact Nicole Owens owens.nicole@epa.gov, at 202 (564-1550).

cc: Bob Perciasepe
Bob Sussman
Deputy Assistant Administrators
Deputy Associate Administrators
Deputy Regional Administrators
Assistant Regional Administrators
Alex Cristofaro
Nicole Owens
Vanessa Wu
Thomas Brennan

Attachment B - Sample Description of Major Planned EPA Action-
Information to be Provided to the SAB

Name of action: Development of Best Management Practices for Recreational Boats Under Section 312(o) of the Clean Water Act

EPA Office originating action: OW

Brief description of action and statement of need for the action:

This action is for the development of regulations by EPA to implement the Clean Boating Act (Public Law 110-288), which was signed by the President on July 29, 2008. The Clean Boating Act amends section 402 of the Clean Water Act (CWA) to exclude recreational vessels from National Pollutant Discharge Elimination System permitting requirements. In addition, it adds a new CWA section 312(o) directing EPA to develop regulations that identify the discharges incidental to the normal operation of recreational vessels (other than a discharge of sewage) for which it is reasonable and practicable to develop management practices to mitigate adverse impacts on waters of the United States. The regulations also need to include those management practices, including performance standards for each such practice. Following promulgation of the EPA performance standards, new CWA section 312(o) directs the Coast Guard to promulgate regulations governing the design, construction, installation, and use of the management practices. Following promulgation of the Coast Guard regulations, the Clean Boating Act prohibits the operation of a recreational vessel or any discharge incidental to their normal operation in waters of the United States and waters of the contiguous zone (i.e., 12 miles into the ocean), unless the vessel owner or operator is using an applicable management practice meeting the EPA-developed performance standards.

Timetable:

Statutory: Phase 1 - 2009, Phase 2 - 2010, and Phase 3 – 2011
Regulatory Agenda: Phase 1 NPRM - 2013, Phase 1FR - 2014

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No

Scientific questions to be addressed and approach:

Recreational boating activities can contribute to the spread of aquatic nuisance species, primarily through the secondary transport of organisms introduced to U.S. waters via other vectors. For example, recreational boating has been linked to the spread of Zebra and Quagga mussels from their initial introduction into the Great Lakes to other U.S. waters. Consequently, the Agency is considering the development of regulations designed to reduce the spread of such organisms by reducing propagule pressure from the recreational vessel vectors. Propagule pressure is a measure

of the number of individual organisms released as well as the number of discrete release events. While there is a general consensus that an increase in propagule pressure increases the probability of establishing a self-sustaining population of an aquatic nuisance species, the probability is a complex function of a wide range of variables. These variables include species traits (e.g., viability, reproductive capability, and environmental compatibility) and environmental traits (e.g., retention of propagules, and interactions with resident species). When addressing secondary transport via recreational vessels, as this project is designed to specifically do, additional variables such as vessel characteristics, voyage type, and propagule exposure need to be considered. Due to the complexity of this issue, the Agency is seeking expert scientific opinions on management practices that can reduce propagule pressure that results from recreational boating activities.

Plans for scientific analyses and peer review:

The Agency is planning to convene a workshop on secondary transport of aquatic nuisance species via recreational vessels. Invited participants will have expertise in the field of invasion biology and each participant will be charged to provide their expert scientific opinion on management practices that the Agency should consider as part of this rule making.

Attachment B

Process for Chartered SAB Discussions of EPA Planned Actions and their Supporting Science

Purpose: to describe the process for chartered SAB discussions of EPA planned actions and their supporting science.

Background:

- The Environmental Research, Development, and Demonstration Authorization Act of 1978 (ERDDAA) requires the EPA to make available to the SAB proposed criteria documents, standards, limitations, or regulations provided to any other Federal agency for formal review and comment, together with relevant scientific and technical information on which the proposed action is based. The SAB may then make available to the Administrator, within the time specified by the Administrator, its advice and comments on the adequacy of the scientific and technical basis of the proposed action.
- EPA has decided to inform the SAB at the time of publication of the Unified (Regulatory) Agenda or the Semi-annual Regulatory Agenda.
- EPA has also decided to provide the SAB with additional information about EPA actions, i.e., short descriptions of major planned actions that are not yet proposed but appear in the semi-annual regulatory agenda (see attached format). This process supplements the Deputy Administrator's annual memorandum requesting program and regional offices to identify scientific issues that might be appropriate for SAB consideration.

Process for Discussions of EPA Planned Actions and their Supporting Science

- The process begins after the EPA informs the SAB is informed about publication of the Unified (Regulatory) Agenda or semi-annual regulatory agenda and provides the SAB with a list and brief descriptions of major planned actions.
- An SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science will be constituted by the SAB Staff Office.
    - The Work Group will include three ongoing members (Work Group Chair, Chair of the Clean Air Scientific Advisory Committee and no more than two additional members) plus additional members from the Chartered SAB chosen each time the unified agenda or semi-annual agenda is released. Those additional members would have expertise related to the science supporting the major actions in that agenda.
- The SAB Work Group will screen the agenda and additional information provided by the agency on major planned actions to identify actions with science of interest. The Work Group will use a format (see attachment) to evaluate major planned actions.

- For those actions of interest to the SAB Work Group, the SAB Staff Office will schedule and document SAB Work Group fact-finding conversations with relevant agency technical staff.
- SAB Work Group will develop preliminary recommendations identifying actions for consideration by the Chartered SAB.
- The Chartered SAB will hold an initial teleconference to consider the preliminary recommendations from the SAB Work Group and to identify any other information needed for decision making.
- The Chartered SAB will hold a teleconference or meeting to determine whether any actions merit SAB additional consideration in order to provide advice and comments on the adequacy of the scientific and technical basis of the proposed action.
- The SAB Chair will document the SAB's determination in a letter to the Administrator.

Format for Agency Description of Potential EPA Tier 1 or Tier 2 Actions

Name of action:

RIN Number:

EPA Office originating action:

Brief description of action and statement of need for the action:

Timetable:

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

Scientific questions to be addressed and approach:

Plans for scientific analyses and peer review:

SAB Work Group Template

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action:

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	**No**
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		
Is the action primarily administrative (i.e., involve reporting or record keeping)?		
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		
Is the action an extension of an existing initiative?		

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	**Medium**	**Low**
Involves scientific approaches that are new to the agency			
Addresses areas of substantial uncertainties			
Involves major environmental risks			
Relates to emerging environmental issues			
Exhibits a long-term outlook			

Identify any additional information needed for development of a recommendation on this action.

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

.

Attachment C
Summary of Science Advisory Board Fact-Finding
Meeting on EPA Planned Actions in the
Spring 2013 Regulatory Agenda

September 26, 2013

Introduction

The Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science was formed to provide the Chartered SAB with recommendations on the actions in the Spring 2013 regulatory agenda provided by the Agency on July 3, 2013. The chartered SAB will consider these recommendations as it determines whether it will provide "advice and comments on the adequacy of the scientific and technical basis" of agency actions, consistent with the requirements of the Environmental Research Development and Demonstration Authorization Act (ERDDAA).

On August 15, 2013, the Work Group received short descriptions from the EPA Program Offices on the major planned actions that are not yet proposed listed in the July 3, 2013 semi-annual regulatory agenda. They held a work session via teleconference on September 4, 2013 to discus preliminary considerations on the planned actions and to identify additional information to assist them in identifying priority actions for SAB advice and comment. The Work Group identified questions about some of the planned actions so that they could provide recommendations to the Chartered SAB on the planned actions. The questions were forwarded to the EPA program offices on September 6, 2013 for responses and preparation for the fact-finding teleconference.

Dr. James Mihelcic, Chair of the Work Group, led members and EPA staff through discussion of the planned actions and the Work Group's questions according to the meeting agenda (Attachment 1). Participants in the September 26, 2013 discussion are listed in Attachment 2.

Summary of Teleconference

PCB Use Authorizations (2070-AJ38)

Question from the Work Group for the Office of Chemical Safety and Pollution Prevention (OCSPP)

Please confirm that this action is only for use of PCBs in electrical equipment and natural gas pipelines and not other sources of exposure (i.e., pigment, paint products). If so, what is the rationale or justification for excluding other sources of PCBs?

Response: OCSPP confirms that the proposed rule will address the following specific areas: (1) the use, distribution in commerce, marking and storage for reuse of liquid PCBs in electric equipment; (2) improvements to the existing use authorization for natural gas pipelines; and (3) definitional and other regulatory "fixes." The proposed rule is limited in scope in terms of uses and there are no scientific issues requiring further analysis.

Discussion: Work Group members noted that recent research in PCB air monitoring indicates concentrations in new buildings and that recently the International Agency for Research on Cancer identified PCB congeners as a group 1 carcinogen. Work Group members asked about other sources of PCBs. OCSPP staff (Tala Henry, Director, National Program Chemicals Division, Office of Pollution Prevention and Toxics) confirmed that that the scope of this action is limited to electrical equipment and pipelines. Dr. Henry noted that EPA already considers PCBs as carcinogenic and there is a review of PCBs underway by EPA's National Center Environmental Assessment in the Integrated Risk Information System.

National Emission Standards for Hazardous Air Pollutants (NESHAP): Brick and Structural Clay Products Manufacturing and Clay Ceramics Manufacturing. (2060-AP69)

Question from the Work Group for the Office of Air and Radiation) (OAR)

What emissions data or other information are being considered to establish emission limits for dioxin for this planned action?

Response: OAR Staff (Keith Barnett, Group Leader, Sector Policies and Programs Division in the Office of Air Quality Planning and Standards) noted that a previous NESHAP for Brick, Structural Clay Products, and Clay Ceramics Manufacturing action was vacated in 2007 after promulgation. The new planned action addresses that decision. Mr. Barnett provided a summary of the data collected to support this planned action including the types of equipment, information on dioxin analytes, and in facility monitoring data for one year.

Revision of Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In-Situ Leaching (2060-AP43)

Question from the Work Group for the Office of Air and Radiation (OAR)

The SAB provided recommendations on EPA's Draft Technical Report entitled *Considerations Related to Post-Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites* in February 2012. Please provide an update on how EPA plans to respond to these recommendations and incorporate the relevant recommendations into the technical support for this action.

Agency Provided Materials: The EPA responded to the SAB review on Post-Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery Sites in a June 12, 2012 letter and provided a detailed listing of the recommendations and EPA actions. The agency's response is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/964968D9229863A0852579A7006EC71A/$File/EPA-SAB-12-005_Response_06-12-2012.pdf

Response: Work Group members noted the detailed table in the agency's June 12, 2012 letter responding to the SABs recommendations. Members asked if there were any changes since that letter was provided. OAR staff (Mary Clark, Science Advisor, and Alan Perrin, Deputy Director, Radiation and Protection Division from the Office of Radiation and Indoor Air) commented that the action was still under formal interagency review with OMB and that consideration of the SAB recommendations was not yet final. They also noted that agency evaluation of the SAB recommendations and new data or information to support the action

would be included in the technical documents that will be developed to support the proposed rule.

National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart W: Standards for Radon Emissions from Operating Uranium Mill Tailings: Review (2060-AP26)

Questions from the Work Group for OAR

Please provide additional information on the scope and background of the settlement agreement.

Please identify the method(s) for radon monitoring and frequency of monitoring at liquid surfaces and any other relevant locations EPA is considering for this planned action.

What types/designs of heap leach piles are being considered for this planned action? How does EPA intend to measure radon emissions from heap leach piles? Can EPA provide or cite technical documents that provide the scientific and technical basis for this action?

Response: OAR staff (Mary Clark, Science Advisor, and Alan Perrin, Deputy Director, Radiation and Protection Division from the Office of Radiation and Indoor Air) elaborated on the short descriptions provided to the Work Group relating to how this action responded to a settlement agreement. They noted that this planned action was in response to an administrative challenge and the agency, as part of that agreement, maintains a webpage detailing the actions development. The web site link is: http://www.epa.gov/radiation/neshaps/subpartw/rulemaking-activity.html

Work Group members asked if the EPA could share any information on the specific monitoring and heap leach field that the agency is considering. OAR staff noted that they do not believe there are currently heap leach piles that would be subject to this planned action. Rather the planned action would serve to include any heap leach fields that are found or developed after the planned action is promulgated.

Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units (2060-AQ91)

Additional information utilized by the Work Group

In addition to the short descriptions that the EPA provided Work Group members identified material on regulations.gov on the April 2012 proposal "Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units (2060-AQ91)." This proposal was withdrawn by the Agency in September 20, 2013. The proposal and public comments in the docket (EPA-HQ-OAR-2011-0660) are available at: http://www.regulations.gov.

OAR Staff also provided a copy of the June 25, 2013 Presidential Memorandum that directed the EPA on power sector carbon pollution standards for electric utility generating units. This direction for new (2060-AQ91) and existing (2060-AQ33) sources in this memorandum is

available at: http://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards

Prior to the September 26, 2013 fact-finding teleconference, OAR staff provided additional information on the planned action, which was signed on September 20, 2013. EPA provided a link to the proposed actions webpage with materials on the Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generation Units. Materials available on the publically available site include several fact sheets, the proposed rule, and Regulatory Impact Assessment (RIA). They may be accessed at: http://www2.epa.gov/carbon-pollution-standards/2013-proposed-carbon-pollution-standard-new-power-plants.

The SAB Staff Office also provided the Work Group with information about the address delivered by Administrator Gina McCarthy to the National Press Club regarding the EPA's priorities in addressing climate change on September 20, 2013. The publically available video of the hour long session is available at: http://www.c-spanvideo.org/program/Gina. The Administrator spoke on the agency's efforts to carrying out President Obama's Climate Action Plan to reduce carbon pollution and address the impacts of a changing climate. She responded to questions submitted by members of the audience at the breakfast.

At the September 26, 2013 fact-finding discussion, Kevin Culligan, Associate Director, Sector Policies and Program Division (SPPD), Office of Air Quality Planning and Standards (OAQPS) provided the EPA Staff response to the SAB Work Group's question. To do so, he provided a power point presentation to describe this action (Attachment 3). After the presentation Mr. Culligan reviewed the written questions from the Work Group to ensure a response was provided for each question. He also addressed additional questions from members of the Work Group.

Questions from the Work Group for OAR

Question: What is the general approach planned for this action? Is it a shift in fuel stock from coal to natural gas or a different approach?

Response: EPA staff stated that the general approach for this action is not a fuel stock shift and described the general approach in the presentation. The Agency evaluated and used new projections of energy capacity developed by the Energy Information Administration (EIA) and others (including utilities' Integrated Resource Plans, IRPs). The Agency also examined the status of available technologies and the status of new projects that are currently under construction or in advanced stages of development. These evaluations indicated that technologies in the proposed rule are available, technically feasible and in line with power sector trends.

Question: Will this new planned action utilize natural gas combined cycle (NGCC) technology? If so please provide the scientific and technical assumption the Agency used to support this approach.

Response: EPA staff noted that this action utilizes NGCC technology after consideration of the industry trends, available technology, and best systems of emission reduction. The standard for new natural gas-fired generation is based on the performance of natural gas combined cycle units

and proposes limits depending on the size of the unit. EPA staff did note that the proposal considers alternative fuel stock sources. The proposed standard for new coal-fired utility boilers and IGCC units is not based on the performance of NGCC units, but rather on the performance of those units implementing partial carbon capture and storage (CCS) technology.

Question: The EPA proposed a similar action in April 2012 that is listed on regulations.gov. Can EPA provide the context and differences between the previously proposed withdrawn rule and this action?

Response: EPA staff noted that there are a number of differences between the April 2012 proposal and the September 20, 2013 proposal. The more recent proposal is a new proposal and not a continuation of the previous proposal. The presentation describes several of those differences. One difference is that the April 2012 proposal provided a fuel-neutral standard while the September 2013 proposal provides a fuel-based standard after consideration of available technologies. The new action proposes separate standards for new natural gas-fired stationary combustion turbines and fossil fuel-fired utility boilers and IGCC units. The new action does not propose a standard of performance for new units that provide less than one third of their total power production to the grid.

Question: Can the agency provide a more detailed description of the planned action that includes information on which new sources the action is applicable?

Response: EPA Staff explained in the presentation that the action will apply to new natural gas-fired stationary combustion turbines that sell more that one-third of their potential output to the grid, fossil fuel-fired utility boilers, and integrated gasification combined cycle units. The standards apply to all such units that commence construction after the date that the proposed standards are published in the Federal Register.

Question: Is the EPA considering carbon capture and sequestration (CCS) technologies for this action? If so can EPA provide a description of the role CCS will play in this action and what scientific documents EPA is using as the basis for considering this technology to be economically and technically viable?

Response: EPA Staff explained that new coal plants will need to consider CCS. Implementing partial CCS was identified as a viable technology for new efficient coal units and would meet the criteria of the best system of emission reduction. The EPA Staff cited National Energy Technology Laboratory (NETL) studies as well as existing projects that are in construction and in advanced stages of development as the bases for this assumption. The NETL studies are all peer reviewed.

Question: What is being assumed about potential for co-firing biomass at coal-based power plants in setting these limits? How will this planned action account for CO_2 emissions from biogenic sources?

Response: The EPA does not propose a policy on biomass in this proposal. EPA Staff noted that there is a discussion in the preamble to the proposed rule and although the Agency

considered this option, it is not included as an option in the proposal. Note that a new utility unit that uses > 90% biomass would not be subject to the proposed standards.

Question: Please provide the basis for the standard that is being set by this planned action that is related to selection of plant size and mass emissions of CO_2 per power generated?

Response: The EPA noted that this rule applies to new fossil fuel-fired EGUs that generate electricity for sale and are larger than 25 megawatts. The rule does not apply to low capacity EGUs that sell less than one-third of their potential output to the grid. EPA focused on larger EGUs in this rule and not on smaller units that provide power for peak consumption hours.

Question: Is a 30–year average of emissions being used for this planned action, if so what is the basis of this approach?

Response: After evaluating the public comments and available information on power sector trends EPA is proposing a different averaging approach than the 30-year approach. After reviewing the public comment and available power sector data EPA proposed an 84 month (7 year) rolling average to meet the proposed standard and replaces the 30-year approach in the April 2012 proposal.

Question: Based on the responses to the previous questions can the EPA provide a description of any peer reviews conducted for the underlying science and technical basis for this action?

Response: EPA cited NETL studies and noted that those studies are all peer reviewed.

Additional Questions from the Work Group

One member asked what drives the percentages to CCS partial capture in this proposal.

Response: EPA Staff noted that the range of captured carbon dioxide from a new unit ranges from roughly 30-50%. This range of capture encompasses the range of rates for technologies and fuels (i.e., supercritical or ultra supercritical technologies or lignite or bituminous coals).

Another member asked about the strength of the cost estimates developed by NETL.

Response: EPA Staff expressed confidence in the assumptions used to develop the analyses and noted that the assumptions are reasonable and peer reviewed

Another member asked if EPA could elaborate on the technical feasibility for CCS in implementing the planned action.

Response: EPA Staff reviewed the three examples of implementing partial CCS in the presentation (page 9) and the strong demonstration these facilities make for the technology.

One member asked if there are any additional studies being considered by EPA that provided information on carbon storage?

Response: EPA Staff noted that this proposal relies on existing sequestration studies and reporting requirements for carbon capture. Mr. Culligan noted that the Agency is working with DOE on this issue and the Office of Water is also involved with geologic sequestration issues under the Underground Injection Control Program.

Greenhouse Gas Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (2060-AR33)

Additional information utilized by the Work Group

In addition to the one-page description of this action, OAR provided the link to the web page for the June 25, 2013 Presidential Memorandum. The memorandum directs the Environmental Protection Agency on power sector carbon pollution standards for electric utility generating units. This direction for new (2060-AQ91) and existing (2060-AQ33) sources in this memorandum is available at: http://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards

The SAB Staff Office also provided the Work Group with information about the address delivered by Administrator Gina McCarthy to the National Press Club regarding the EPA's priorities in addressing climate change on September 20, 2013. The publically available video of the hour long session is available at: http://www.c-spanvideo.org/program/Gina. The Administrator spoke on the agency's efforts to carrying out President Obama's Climate Action Plan to reduce carbon pollution and address the impacts of a changing climate. She responded to questions submitted by members of the audience at the breakfast.

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Response:

Kevin Culligan, Associate Director, Sector Policies and Program Division (SPPD), Office of Air Quality Planning and Standards (OAQPS) provided a power point presentation (Attachment 4) to describe this action. After the presentation Mr. Culligan reviewed the written questions from the Work Group to ensure a response was provided for each question. He also addressed additional questions from members of the Work Group.

Questions from the Work Group for OAR

Question: The EPA description of this action appears to be the same approach used for the planned action Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units (2060-AQ91). Based on the similarity in the two actions the workgroup asks similar questions as in the proposed action (2060-AQ91) focusing on existing sources.

What are the general approaches being considered for this planned action? Is it a shift in fuel stock from coal to natural gas or a different approach? Can the Agency provide a more detailed description of the planned action that includes information on which sources the action will be applicable to?

Response: The EPA is evaluating many approaches and options at this stage of the rulemaking process. The planned action for existing sources will need to consider different approaches than the new source proposal.

Question: Is the EPA considering carbon capture and sequestration (CCS) technologies for this planned action? If so can EPA provide a description of the role CCS will play in this action and what scientific documents EPA is using as the basis for considering this technology to be economically and technically viable?

Response: At this time CCS may not be a feasible technology across the spectrum of electricity generating units. While feasible in new plants EPA does not anticipate application of this technology across all plants.

Question: What is being assumed about potential for co-firing biomass at coal-based power plants in setting these limits? How will this proposed action account for CO_2 emissions from biogenic sources?

Response: EPA anticipates conducting stakeholder listening sessions to discuss the planned action and has not yet developed the options for this planned action.

Question: Please provide a description of any peer reviews conducted for the underlying science and technical basis for this planned action.

Response: The EPA will be using the best science available to consider options for the planned action. Sources like NETL technical reviews will be considered but it is too early to provide more specific source.

Question: Please provide the basis for the standard that EPA is considering for this planned action that is related to selection of plant size and mass emissions of CO_2 per power generated?

Response: The EPA is conducting stakeholder listening sessions to discuss the planned action and has not yet developed the options for this planned action.

Question: Is a 30–year average of emissions being considered for this planned action, if so what is the rationale being considered of this approach?

Response: The 30-year averaging compliance option was specific to the CCS alternatives for new plants in the April 2012 proposal. EPA has not yet developed the options for this planned action.

Question: Based on the responses to the previous questions can the EPA provide a description of any peer reviews conducted for the underlying science and technical basis for this action?

Response: The EPA will be using the best science available to consider options for the planned action. Sources like NETL technical reviews will be considered but it is too early to provide more specific source.

Additional Questions from the Work Group

One workgroup member noted the Agency's reliance on NETL products and asked how EPA is engaging the scientific community and vetting the scientific and technical basis for the planned action?

Response: EPA staff noted that they are also evaluating power sector modeling results and these models are peer reviewed. Staff also explained that assumptions used in the model formulation are also peer reviewed. In addition to the power sector modeling, EPA staff cited technology data from the EIA and DOE are being considered In additional to the peer review that IPM has undergone, EPA staff participate in the Stanford Energy Modeling Forum where results from EPA"s power sector models are compared to results from other models developed by industry and academia.

Another member asked if the EPA anticipated bringing the planned action to the SAB for review?

Response: EPA staff noted that the power sector modeling and power sector analyses EPA is considering for this planned action do not present new scientific or technology issues. Rather, EPA, through this planned action, is not advancing the technical and scientific underpinnings, but developing the best implementation approaches that are reasonable to ask states to implement.

Attachment 1
Work Session for the SAB Work Group
on EPA Planned Actions for SAB Consideration of the Underlying Science
September 26, 2013, 3:00 – 5:00 p.m. ET
Draft Agenda

Call in Number: 1 866 299 3188
Conference Code: 202 564 4885#

Purpose: To discuss the questions sent by the SAB Work Group to the EPA Program Offices and receive additional information from EPA on the planned actions .

Introduction / Agenda review	5 minutes	Dr. James Mihelcic
Discussion with OCSPP Staff on planned action: • PCB Use Authorizations (**2070-AJ38**)	10 minutes	Dr. Tala Henry, Director, National Program Chemicals Division, Office of Pollution Prevention and Toxics
Discussion with OAR Staff 0n planned actions		
• National Emission Standards for Hazardous Air Pollutants (NESHAP): Brick and Structural Clay Products Manufacturing and Clay Ceramics Manufacturing. (**2060-AP69**)	15 minutes	Mr. Keith Barnett, Group Leader, Sector Policies Program Division, Office of Air Quality Planning and Standards
• Revision of Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In-Situ Leaching (**2060-AP43**) • National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart W: Standards for Radon Emissions from Operating Uranium Mill Tailings: Review (**2060-AP26**)	15 minutes	Mary Clark, Science Advisor Office of Radiation and Indoor Air Alan Perrin Deputy Director Radiation and Protection Division,

		ORIA
• Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units (**2060-AQ91)**	30 minutes	Kevin Culligan Associate Director Sector Policies and Program Division, Office of Air Quality Planning and Standards
• Greenhouse Gas Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (**2060-AR33**)	30 minutes	
Next steps Adjourn	5 minutes	Dr. James Mihelcic Thomas Carpenter, DFO

Attachment 2
Participants in the Science Advisory Board Fact-Finding Meeting on EPA Planned Actions in the Spring 2013 Regulatory Agenda

September 26, 2013

Member s of Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Dr. James R. Mihelcic, Chair
Dr. Taylor Eighmy
Dr. R. William Field
Dr. H. Christopher Frey
Dr. Madhu Khanna
Dr. Peter S. Thorne

SAB Staff Office

Dr. Angela Nugent, Designated Federal Officer
Mr. Thomas Carpenter, Designated Federal Officer
Mr. Christopher Zarba

EPA Staff

Office of Chemical Safety and Pollution Prevention

Dr. Tala Henry, Director, National Program Chemicals Division, Office of Pollution Prevention and Toxics

Office of Air and Radiation

Mr. Keith Barnett, Group Leader, Sector Policies Program Division, Office of Air Quality Planning and Standards

Dr. Mary Clark, Science Advisor, Office of Radiation and Indoor Air

Mr. Alan Perrin, Deputy Director, Radiation and Protection Division, ORIA

Mr. Kevin Culligan, Associate Director, Sector Policies and Program Division, Office of Air Quality Planning and Standards

Dr. Nick Hutson, Energy Strategies Group
U.S. Environmental Protection Agency

Ms. Rona Birnbaum, Chief, Climate Science and Impacts Branch
Climate Change Division, Office of Atmospheric Programs, OAR

Mr. Carl Mazza, Senior Advisor, OAR

Reducing Carbon Pollution from New EGUs

U.S. Environmental Protection Agency
Office of Air and Radiation

Clean Air Act Section 111

- Authorized in 1970
- Establishes a mechanism for controlling air pollution from stationary sources
  - Applies to sources for which the Administrator, in her judgment, finds "causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare"
  - Can apply to new, existing, modified and reconstructed sources
- More than 70 stationary source categories and subcategories are currently regulated under section 111
  - A full list is available in 40 CFR Part 60

2

Clean Air Act Section 111

- Lays out different approaches for new and existing sources
  - **New sources under section 111(b)**
    - Federal standards for new, modified and reconstructed sources
  - **Existing sources under section 111(d)**
    - State programs for existing sources that are equivalent to federal guidelines

3

Clean Air Act Section 111(b)

Statutory Authority

- Clean Air Act (CAA) section 111(b) requires EPA to regulate new sources.
  - **Section 111(b) – Federal Program for New Sources**
    - The Administrator shall "establish Federal standards of performance" for "new sources within [the] source category."
  - "**Standard of Performance**"
    - "A standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction, which (taking into account the cost of achieving such reduction and any non-air quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."

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BSER: Best System of Emission Reduction

Key Factors in BSER Determination For New Power Plants

- **Feasibility**
  System of emission reductions must be technically feasible
- **Costs**
  Costs of the system are reasonable
- **Size of reductions**
  EPA may consider the amount of emission reductions the system would generate
- **Technology**
  Designed to promote the implementation and further development of technology

5

Proposed Carbon Pollution Standards for New Sources

- EPA is proposing to set separate standards for new natural gas-fired turbines and coal-fired units.
- The standards apply to new
  - natural gas-fired stationary combustion turbines
  - fossil fuel-fired utility boilers and integrated gasification combined cycle (IGCC) units

6

Proposed Carbon Pollution Standards for New Sources

Natural gas-fired stationary combustion turbines

- Standard based on the performance of modern natural gas combined cycle (NGCC) units
- Proposing 2 limits depending on the size of the unit.
- Proposed limits are:
  - 1,000 pounds of CO_2 per megawatt-hour (lb CO_2/MWh gross) for larger units (>850 mmBtu/hr)
  - 1,100 lb CO_2/MWh gross for smaller units (≤850 mmBtu/hr)

7

Proposed Carbon Pollution Standards for New Sources

Fossil fuel-fired utility boilers and IGCC units

- Standard based on performance of a new efficient coal unit implementing partial carbon capture and storage (CCS)
- Limits would lead to capture of only a portion of the CO_2 from a new unit (roughly 30%-50%)
- Proposing two limits, depending on the compliance period that best suits the unit.
- Proposed limits are
  - 1,100 lb CO_2/MWh gross over a 12-operating month period, or
  - 1,000-1,050 lb CO_2/MWh over an 84-operating month period

8

BSER analysis: Utility boilers and IGCC units

New efficient coal unit implementing partial CCS meets the criteria of BSER

- **Feasibility:** A number of examples in operation, under construction and or under development most notably:
  - Kemper County Energy Facility (582 MW IGCC) – Mississippi
    - Plans to capture 65% CO2
    - Under construction (over 75% complete)
  - Great Plains Synfuels Plant – North Dakota
    - Capturing 50% of CO_2 for more than 10 years
    - Gasification component of IGCC
  - Boundary Dam (rebuild;110 MW PC) – Canada
    - 90% capture
    - Expected to be in operation by Spring of 2014
- **Costs:** Comparable to cost of other generation technologies meeting similar function
- **Size of reductions:** Range of CO_2 capture needed to meet standard (25 – 40%)
- **Technology:** Promotes innovation and development of CCS

9

Flexibility for New Coal Plants

- Proposing option for coal-fired units to use an 84-operating month rolling average of CO_2 emissions to meet the proposed standard, rather than meeting the standard over 12-months.
  - Emission limit would be more stringent (request comment on a range between 1,000 - 1,050 lb CO_2/MWh)
- Maintains the flexibility for units using partial CCS to optimize the system over several months, while setting a more reasonable time period for reporting and assuring compliance with the standard.
- Replaces 30-year timeframe in April 2012 proposal
  - Commenters supported the flexibility provided by a multi-year averaging period but many felt that 30 years was not a practical timeframe.

10 10

Proposed Standards In Line with Power Sector Trends

- According to new capacity projections made by EIA – and confirmed by additional EPA analysis -- the rule is not projected to require changes in the design or construction of new units.
- Most new electricity generating capacity is forecast to be either natural gas-fired or renewable.
- These units would already meet the standards proposed in this rule or are not covered by this rule
- The North American Electric Reliability Corporation's (NERC) Long Term Reliability Assessment, which is based on utility plans for new generating capacity over a 10-year period, [1] reinforces this likelihood by stating that "gas-fired generation [is] the primary choice for new capacity."

1. NERC, Long-Term Reliability Assessments for 2009 (Table 5) and 2012 (Figure 51). Capacity includes both planned and conceptual resources as defined by NERC.

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Existing Source Standards

U.S. Environmental Protection Agency
Kevin Culligan
Office of Air and Radiation

Reducing Carbon Pollution From Power Plants

President's Directive to EPA:

- Set flexible carbon pollution standards, regulations or guidelines, as appropriate, for power plants under section 111 of the Clean Air Act
- Focus on these elements when developing the standards
  - Stakeholder engagement on program design
    - States
    - Leaders in the power sector
    - Labor leaders
    - Non-governmental organizations
    - Tribal officials
    - Members of the public
  - Flexibilities in the program design
    - Market-based instruments, performance standards, others
  - Costs
    - Tailor regulations and guidelines to reduce costs
  - Continued importance of relying on a range of energy sources
  - Other regulations that affect the power sector

2

Clean Air Act Section 111

- Authorized in 1970
- Establishes a mechanism for controlling air pollution from stationary sources
  - Applies to sources for which the Administrator, in his or her judgment, finds "causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare"
  - Can apply to new, existing, modified and reconstructed sources
- Technology-based regulations
- More than 70 stationary source categories and subcategories are currently regulated under section 111
  - A full list of sources regulated under section 111 can be found in 40 CFR Part 60

3

Clean Air Act Section 111 (cont.)

- Lays out different approaches for new and existing sources
  - **New sources under section 111(b)**
    - Federal standards for new, modified and reconstructed sources
  - **Existing sources under section 111(d)**
    - State programs for existing sources that are equivalent to federal guidelines

4

Clean Air Act Section 111 (cont.)

Section 111(d) for Existing Sources

- Requires a different approach for achieving emission reductions than the approach used for new sources
- Provides that EPA establish
  - A procedure for states to issue performance standards for existing sources in the source category and
  - Guidance about the appropriate level of the standard
- EPA has established section 111 (d) regulations for existing sources for 5 source categories

On the books section 111(d) regulations

- Sulfuric acid plants (acid mist)
- Phosphate fertilizer plants (fluorides)
- Primary aluminum plants (fluorides)
- Kraft pulp plants (total reduced sulfur)
- Municipal solid waste landfills (landfill gases)

5

Clean Air Act Section 111 (cont.)

Section 111(d) is broad by design

- Congress anticipated that there might be air pollution problems beyond those covered by national ambient air quality standards (such as ozone and fine particle pollution) or air toxics standards that EPA would need to address
- Also recognized that existing sources do not have as much flexibility as new ones to build emission controls into their design
- Therefore, the statutory language in section 111(d) is broad
- Section 111 (d) provides greater flexibility to EPA and states to design a program in consultation with diverse range of stakeholders

6

Clean Air Act Section 111 (cont.)

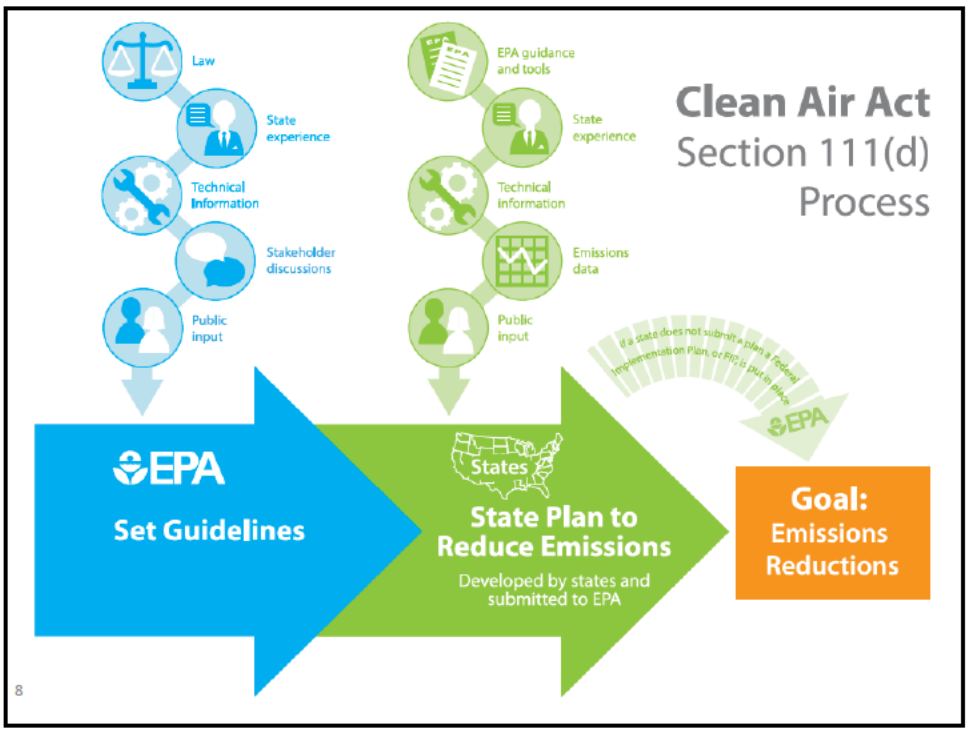
How Section 111(d) Has Worked

- EPA previously has set "emission guidelines" for 5 source categories
  - Has not prescribed technology that must be used to comply
- Once EPA set the guidelines, states developed section 111(d) plans establishing standards of performance for the covered sources in their state
- States then submitted section 111(d) plans to EPA for review and approval
- EPA subsequently evaluated the plans and took action through notice and comment rulemaking
- EPA has authority to prescribe a plan for a state in cases where the state fails to submit a satisfactory plan and to enforce the provisions of a plan in cases where the state fails to enforce them

Common elements of past guidelines

- Description of BSER that has been adequately demonstrated
- Degree of emission limitation achievable, costs and environmental impacts of application
- Time required to implement
- Other information to facilitate formation of state plans
- A goal for reductions – or "standard of performance" -- based on a BSER analysis

7



8

Clean Air Act Section 111 (cont.)

How State Plans Have Worked

- States determine the combination of measures that will meet the guidelines
- State plans set standard of performance
  - Can be identical to EPA's guidelines (states adopt EPA's model rules)
  - Can differ from, but be equivalent to, EPA's guidelines
- State plans provide for implementation and enforcement
  - States have had flexibility when applying the standard of performance in their plans to take into consideration, among other factors, the remaining useful life of the source
- Timeframe to submit state plans has been set by EPA in the guidelines

9

Clean Air Act Section 111 (cont.)

Section 111(d) and Carbon Pollution

- In general, carbon pollution emissions differ from the pollutants that have been regulated in the past under section 111(d)
- Carbon pollution is:
  - Global
  - An order of magnitude greater than the other pollutants covered under section 111(d) in the past
  - Accumulating and remaining in the atmosphere over hundreds of years
- We have opportunities to explore various program designs and flexibilities because of
  - The broad statutory language of section 111(d)
  - The unique characteristics of carbon pollution
  - The interconnected nature of the power sector

10

The Electric Power Sector

- The electric power sector accounted for 33% of U.S. total GHG emissions and 60% of U.S. stationary source GHG emissions in 2011
- Fossil fuel-fired power plants are the largest source of U.S. CO_2 emissions
  - *Fossil fuel-fired power plants* use natural gas, petroleum, coal or any form of solid, liquid, or gaseous fuel derived from such material for the purpose of generating electricity

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Reducing Carbon Pollution from the Power Sector

- Many states already have climate and energy policies that reduce GHGs from the electric power sector
- Their programs show that opportunities for cost-effective reductions may range from direct measures at individual EGUs to indirect measures that reduce overall electricity demand or increase the use of low- or non-emitting generation
- To build a section 111(d) program that preserves and supports states' leadership, we would like to know more about state programs that exist today, how they work, lessons learned from state experience, and what states are planning for the near future

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Reducing Carbon Pollution from the Power Sector (cont.)

Design Approaches

- **Source-based approach**
  - Evaluates emission reduction measures that could be taken directly by affected sources (power plants)
- **System-based approach**
  - Evaluates broader portfolio of measures including those that could be taken beyond the affected sources but still reduce emissions at the sources

These approaches illustrate the range of designs that stakeholders have suggested under section 111(d)

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Reducing Carbon Pollution from the Power Sector (cont.)

Options to lower CO_2 emissions from existing power plants

- **Supply-side options**
  - Actions occur at the regulated source itself or other power plants
- **Demand-side options**
  - Actions occur at locations where electricity is used, as well as transmitted and distributed – not at the regulated source or other power plants

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Reducing Carbon Pollution from the Power Sector (cont.)

- **Supply-side options**
  - Directly reduce/avoid power plant CO_2 emissions through energy efficiency at the source
  - Indirectly reduce/avoid power plant CO_2 emissions by increasing the use of low- and non-emitting electric generation
- Examples
  - Heat rate improvements /energy efficiency at the EGU
  - Fuel switching to a lower-emitting fuel or co-firing with a lower-emitting fuel
  - Re-dispatch of EGUs based on CO_2 emission rate
  - Renewable energy portfolio requirements

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Reducing Carbon Pollution from the Power Sector (cont.)

- **Demand-side options**
  - Indirectly reduce/avoid power plant CO_2 emissions by lowering electricity demand
    - Reduces the overall amount of electricity generated at CO_2 emitting power plants
    - May also change the dispatch of electric generators in response to lower electricity demand
- Examples
  - End-use energy efficiency requirements and programs
  - Demand-side management programs

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Attachment 5

Carpenter, Thomas

From: Mazza, Carl
Sent: Thursday, October 31, 2013 4:17 PM
To: Carpenter, Thomas
Cc: Culligan, Kevin
Subject: FW: Will come by later

Tom you asked for additional information on the NETL data/information that played a role in the 111(d) proposed rules and the peer review to which they have been subjected. While we have had a busy schedule of outreach meetings this week we did reach out to NETL and have included the summary they provided in the response below.

EPA Technical staff will be available at the upcoming SAB meeting for any questions.

Carl

From: Culligan, Kevin
Sent: Thursday, October 31, 2013 2:16 PM
To: Mazza, Carl
Subject: Will come by later

Proposed emission limits for utility boilers and IGCC units

The EPA relied on information contained in reports from the US Department of Energy's National Energy Technology Laboratory (DOE/NETL). The DOE/NETL has released a series of reports on the 'Cost and Performance Baselines for Fossil Energy Plants'. The studies were conducted to establish estimates for the cost and performance of combustion and gasification based power plants as well as options for co-generating synthetic natural gas and fuels, all with and without carbon dioxide capture and storage.

The EPA relied on the cost and performance data in Volume 1 of the series – "Cost and Performance Baseline for Fossil Energy Power Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity" (and subsequent updates) – available at http://www.netl.doe.gov/energy-analyses/baseline_studies.html

The power plant configurations analyzed in the study were modeled using the ASPEN Plus® (Aspen) modeling program. Performance and process limits were based upon published reports, information obtained from vendors and users of the technology, cost and performance data from design/build utility projects, and/or best engineering judgment. Capital and operating costs were estimated by WorleyParsons based on simulation results and through a combination of existing vendor quotes, scaled estimates from previous design/build projects, or a combination of the two. Operation and maintenance (O&M) costs and the cost for transporting, storing, and monitoring (TS&M) carbon dioxide (CO_2) in the cases with carbon capture were also estimated based on reference data and scaled estimates. The cost of electricity (COE) was determined for all plants assuming investor-owned utility (IOU) financing.

The initial results of this analysis were subjected to a significant peer review by industry experts, academia and government research and regulatory agencies. Based on the feedback from these experts, the report was updated both in terms of technical content and revised costs.

From: Mazza, Carl
Sent: Thursday, October 31, 2013 1:38 PM
To: Culligan, Kevin
Subject: come bye or call…thanks

Carl Mazza, Ph.D.
Science Advisor,
Office of Air and Radiation

Attachment 5

Carpenter, Thomas

From: Kristin Gerdes [Kristin.Gerdes@NETL.DOE.GOV]
Sent: Thursday, October 31, 2013 4:55 PM
To: Carpenter, Thomas
Cc: Eric Grol; James Black; John Wimer; Sean Plasynski
Subject: Peer review of referenced NETL studies in EPA NSPS

Mr. Carpenter,

In response to your voicemail request, below is information regarding publically available information on peer reviews of the DOE/NETL studies referenced in the proposed EPA NSPS rule.

"Cost and Performance Baseline for Fossil Energy Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity" was originally released in May 2007. As part of development of that report, a peer review was conducted as described in the text of the preamble (NETL Viewpoint) to the report, shown below.

"The initial results of this analysis were subjected to a significant peer review by industry experts, academia and government research and regulatory agencies. Based on the feedback from these experts, the report was updated both in terms of technical content and revised costs."

Reviewers were sent the report and given several weeks for review and the regulatory agency that provided the review was the EPA. Beyond this we do not have a documented or publically-available description for this peer review process as it was specifically tailored for this report.

Revision 1 to this report was minor and issued several months after the original. Neither the November 2010 update to this report (Revision 2) nor the separate report updating costs to 2011 dollars (August 2012) went through a peer review.
For reference, these reports can be found here: http://www.netl.doe.gov/energy-analyses/baseline_studies.html

The August 2011 report "Cost and Performance of PC and IGCC Plants for a Range of Carbon Dioxide Capture" which modified the CO2 capture rates for select cases presented in the "Cost and Performance Baseline for Fossil Energy Plants" did not undergo peer review. That report can be found here: http://www.netl.doe.gov/energy-analyses/refshelf/PubDetails.aspx?Action=View&PubId=396

Please let me know if you have additional questions.

Regards,
Kristin

Kristin J. Gerdes
Director of Performance Division
Office of Program Performance and Benefits
National Energy Technology Laboratory

Attachment D
Descriptions of Major EPA Planned Actions Identified in the July 2013 Semi-Annual Regulatory Agenda with SAB Work Group Recommendations

OFFICE OF AIR AND RADIATION

Name of action: 2014 Standards for the Renewable Fuel Standard Program, Notice of Proposed Rulemaking

RIN Number: 2060 - AR76

EPA Office originating action: OAR/Office of Transportation and Air Quality

Brief description of action and statement of need for the action:

Under Clean Air Act Section 211(o), EPA is required to set annual percentage standards under the Renewable Fuels Standard (RFS) program based on gasoline and diesel projections from the Energy Information Administration (EIA). This regulatory action will propose the 2014 annual percentage standards for the RFS program for cellulosic biofuel, biomass-based diesel, advanced biofuel, and total renewable fuel. These standards will apply to all gasoline and diesel produced or imported in 2014.

Timetable: The Agency intends to propose the 2014 RFS volumes in late September following interagency review.

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No work products meeting this description will be developed for this rulemaking. Consistent with past rulemakings which set the annual RFS standards, the analyses conducted for the determination of the required volume of cellulosic biofuel will be based on consultation with EIA, information from stakeholders, confidential and non-confidential information from individual producers of renewable fuels, and our own assessment of industry capabilities for facility startup and production ramp-up periods. The determination of the required volumes for advanced biofuel and total renewable fuel will be based on an assessment of the ability of the renewable fuels industry to produce sufficient renewable fuels and make them available to the vehicles that can use them.

Scientific questions to be addressed and approach:

See description of analysis above

Plans for scientific analyses and peer review:

See description of analysis and involvement of non-EPA entities above

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Renewable Fuel 2014 Obligations (2060-AR76)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks			X
Relates to emerging environmental issues			X
Exhibits a long-term outlook			X

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This action does not merit further SAB consideration. This action involves consulting industry, EIA and other stakeholders to determine the feasible volume of advanced renewable fuels that can be met by industry given the current state of technology. This is an ongoing activity undertaken each year by the EPA. There is no new scientific approach underlying this action that needs to be reviewed by the SAB.

Name of action: Review of the National Ambient Air Quality Standards for Lead (SAN 5475)

RIN Number: 2060-AQ44

EPA Office originating action: Office of Air and Radiation

Brief description of action and statement of need for the action: Under the Clean Air Act, EPA is required to review and, if appropriate, revise the air quality criteria and the primary (health-based) and secondary (welfare-based) national ambient air quality standards (NAAQS) every five years. Each review generally includes the preparation of an Integrated Science Assessment (ORD), Risk/Exposure Assessment (OAR), as warranted, and a Policy Assessment Document (OAR). Each draft of these assessment documents, which inform the Administrator's proposed and final decisions as to whether to retain or revise the standards, is reviewed by EPA's Clean Air Scientific Advisory Committee (CASAC). Established in 1977 under the Clean Air Act (CAA) Amendments of 1977 (see 42 U.S.C. § 7409(d)(2)), CASAC provides independent advice to the EPA Administrator on the scientific and technical bases for the NAAQS and recommends to the Administrator any new standards or revisions of existing criteria and standards as appropriate under CAA sections 108 and 109. The Chair of the CASAC also serves as a member of the chartered Science Advisory Board. The SAB is responsible for selection of CASAC members and overall management of CASAC.

Timetable:

Integrated Science Assessment (final): 2013

Policy Assessment (draft): January 2013

Policy Assessment (final): Fall 2013

Regulatory Agenda - NPR: 2014

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

Yes. All major assessment documents compiled by EPA that form the basis for the review of the lead standards are reviewed by CASAC in accordance with the requirements of CAA section 109(d)(2).

Plans for scientific analyses and peer review:

SAB peer review conducted: all major assessment documents compiled by EPA have been reviewed by CASAC.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Review of the National Ambient Air Quality Standards for Lead (2060-AQ44)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	**No**
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?	X	
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"	X	
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	**Medium**	**Low**
Involves scientific approaches that are new to the agency		X	
Addresses areas of substantial uncertainties	X		
Involves major environmental risks		X	
Relates to emerging environmental issues		X	
Exhibits a long-term outlook		X	

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This action does not merit further SAB consideration. It has already been reviewed in detail by CASAC as part of a multi-year review cycle, and a final report from CASAC has already been communicated to the EPA Administrator. The chartered CASAC has a specific role for reviewing NAAQS under the Clean Air Act. It would be duplicative and unnecessary for SAB to also conduct a review. Therefore, it is recommended that SAB not conduct a review of this action.

Name of action: National Emission Standards for Hazardous Air Pollutants (NESHAP): Brick and Structural Clay Products Manufacturing and Clay Ceramics Manufacturing

RIN Number: 2060-AP69

EPA Office originating action: OAR

Brief description of action and statement of need for the action:

The EPA has determined that the clay products manufacturing industry may reasonably be anticipated to emit several of the hazardous air pollutants (HAPs) listed in Section 112(b) of the Clean Air Act (CAA), as amended in 1990. As a consequence, clay products manufacturing was included in the initial list of HAP-emitting categories published July 16, 1992, in the Federal Register and included in the draft schedule for the promulgation of emission standards published in the Federal Register on September 24, 1992. As a result of judicial review, the standards were subsequently vacated and are being redeveloped in this action.

This rulemaking will establish emission limits for hazardous air pollutants (HF, HCl, dioxin and metals) emitted from brick and clay ceramics kilns, as well as dryers and glazing operations at clay ceramics production.

Timetable:

EPA is under court-ordered deadlines to issue a notice of proposed rulemaking by February 16, 2014, and a final rule by December 18, 2014.

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No, this action does not rely on new science. These standards will be based on currently available emission data. As required under Section 112(b) these Standards are technology based. Standards for existing sources will be based on the average emission limitation achieved by the best performing 12 percent of existing sources in the category, while standards for new sources will be based on the best performing existing source in the same category.

Scientific questions to be addressed and approach:

The proposed rule will be based on EPA evaluation of currently available emissions data, current practice and applicable/available technologies in use within the industry.

Plans for scientific analyses and peer review:

Not applicable

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: NESHAP: Brick and Structural Clay Products and Clay Products (2060-AP69)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative? *		X

* The 1992 inclusion of HAPs for clay products manufacturing was vacated by judicial review. Therefore this would not be considered an extension of an existing initiative.

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks			X
Relates to emerging environmental issues			X
Exhibits a long-term outlook			X

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This action does not merit further SAB consideration. The EPA is required to set emission standards for hazardous air pollutants from brick and clay ceramic kilns and ceramic production operations. These will be determined by industry ability to achieve these standards and will be based on practices of the best performing facilities. No new scientific activity is expected to underlie this action.

Name of action: Prevention of Significant Deterioration for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$) – Increments, Significant Impact Levels and Significant Emission Rates: Reconsideration (SAN 5594)

RIN Number: 2060-AR28

EPA Office originating action: Office of Air and Radiation

Brief description of action and statement of need for the action: This rulemaking addresses legal challenges brought against the EPA's 2010 PSD rule for $PM_{2.5}$, including (1) a January 22, 2013, remand by the U.S. Court of Appeals for the D.C. Circuit (Court) concerning the $PM_{2.5}$ significant impact levels (SILs) and significant monitoring concentration (SMC), and (2) a pending court challenge and related administrative petition for reconsideration from the Texas Commission on Environmental Quality (TCEQ) on related issues. Both the remand and the petition address provisions contained in the 2010 Final PSD Rule for $PM_{2.5}$ Increments, SILs and SMC (75 FR 64864, October 20, 2010). This rulemaking will respond to the Court's remand by revising the $PM_{2.5}$ SILs provision contained in paragraph (k)(2) at 40 CFR 51.166 and 52.21 of the PSD regulations that included the numerical values of $PM_{2.5}$ SILs and statements about their role in completing an air quality impact analysis with regard to the $PM_{2.5}$ NAAQS. This rulemaking will also reconsider the significant emission rates (SER) for $PM_{2.5}$ and precursor emissions. We intend to develop SERs for direct $PM_{2.5}$ emissions and for $PM_{2.5}$ precursors that are aligned with the reconsidered SILs in the sense that, generally speaking, only emission increases greater than the SERs would be expected to result in ambient impacts greater than the SILs. This rulemaking is also intended to address the administrative petition from TCEQ for reconsideration of the 2010 final rule.

Timetable:

- Preliminary Analytical Blueprint under development – August 2013
- Proposal target date – May 2014

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No. The key issue in this rulemaking is legal and policy in nature, in particular whether the Clean Air Act allows EPA to set SILs for ambient impacts from new and modified sources based on a *de minimis* rationale and whether the levels to be proposed by EPA are in fact *de minimis* in the sense of allowing only trivial deviations from Clean Air Act requirements for permits.

Scientific questions to be addressed and approach:

The only scientific question in this rulemaking concerns the establishment of SERs for PM2.5 precursors that correspond to particular ambient impact levels for PM2.5, such that sources with emissions below a SER are highly unlikely to have PM2.5 ambient impacts above that particular level and therefore whether, as a matter of policy, is it a poor use of resources to require permit

applicants to conduct modeling or other quantitative analysis as part of the permit application process.

Plans for scientific analyses and peer review:

We intend to explore the above science question using air quality models that have already completed peer review, particularly CMAQ and/or CAMx.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$) – Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration: Reconsideration **(**2060-AR28)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	**No**
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	**Medium**	**Low**
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks		X	
Relates to emerging environmental issues			X
Exhibits a long-term outlook		X	

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This action does not merit further SAB consideration. The proposed rulemaking addresses legal challenges to portions of an existing initiative and proposes revisions of PM2.5 Significant Impact Levels; however, it does not appear to rely on new science. The key issue at hand is whether the EPA under the CAA can set Significant Impact Levels based on a de minimis rationale and whether the levels proposed are de minimis

Name of action: Proposed Rulemaking for 40 CFR Part 61, Subpart W: Revision of National Emission Standard for Radon Emissions from Operating Mill Tailings

RIN Number: 2060-AP26

EPA Office originating action: OAR

Brief description of action and statement of need for the action:

Clean Air Act amendment to an existing rule proposes to control radon emissions by establishing Generally Available Control Technology (GACT) standards for operating impoundments, evaporation ponds, and heap leach piles containing uranium byproduct material. The proposal maintains work practice standards for operating conventional impoundments constructed after December 1989, and replaces radon monitoring requirements with work practice standards for operating impoundments constructed earlier. New work practice standards are proposed for evaporation ponds (maintaining a specified level of liquid) and heap leach piles (maintaining a specified saturation level). Rulemaking is in response to a settlement agreement with stakeholders.

Timetable:

June 2013	Transmittal to OMB
November 2014	Publication for comment

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No. This is a limited action proposing technology/work practice standards to limit radon emissions.

Scientific questions to be addressed and approach:

Issues for public comment include availability of methods for monitoring radon at liquid surfaces (EPA did not identify such methods) and technical questions regarding maintaining and measuring saturation level of heap leach piles.

Plans for scientific analyses and peer review:

The technical basis for subpart W was peer reviewed by the SAB in 1989, and as indicated above, this technical basis will not change for the proposed revision.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart W: Standards for Radon Emissions from Operating Uranium Mill Tailings: Review (RIN: 2060-AP26)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency		X	
Addresses areas of substantial uncertainties		X	
Involves major environmental risks		X	
Relates to emerging environmental issues		X	
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This action does not merit further SAB consideration. The SAB's Radiation Advisory Committee completed a review of the technical basis for Subpart W of the NESHAPs in 1988 – http://yosemite.epa.gov/sab/sabproduct.nsf/CC0AEE6D42E6E6ED8525732500695FF8/$File/NESHAP-RADIONUCLIDES++RAC-89-003_89003_5-22-1995_217.pdf. The EPA is using the same technical basis for this planned revision.

"The National Emission Standards for Hazardous Air Pollutants (NESHAP) subpart W protects human health and the environment by setting radon emission standards and work practices for

operating uranium mill tailings impoundments. EPA is in the process of reviewing this standard. If necessary, the agency will revise the NESHAP requirements for radon emissions from operating uranium mill tailings." Subpart W includes: 1) designation of facilities, definitions, standards, determining compliance, annual reporting requirements, recordkeeping requirements, and exemptions from the reporting and testing requirements of 40 CFR 61.10.

In the standard, radon-222 emission rates are limited to 20 picocuries per square meter per second and the standard requires that new tailings impoundments meet specified work practice standards. EPA plans to propose a rule on Subpart W in late October 2013 with a final decision in 2014. The Subpart W rulemaking package was accepted by OMB on June 6, 2013. Additional information concerning the proposed action is located at Website is located at:

www.epa.gov/radiation/neshaps/subpartw/rulemaking-activity.html. Minutes from an April 13, 2013 EPA stakeholder conference call included the statement from Reid Rosnick (ORIA) that the rule will address conventional mills, in situ recovery, as well as heap leach and that until the rule is proposed it is considered to be internal and deliberative - http://www.epa.gov/radiation/docs/neshaps/subpart-w/subpartwquarterlyconferencecall-0410313.pdf.

Summary discussion with Agency

The SAB Work Group had a conference call on September 26, 2013 with Mary Clark (Science Advisor Office of Radiation and Indoor Air) and Alan Perrin (Deputy Director,

Radiation and Protection Division, ORIA) to collect additional information about the planned action. A website describing the agreement and other supporting information was provided – http://www.epa.gov/radiation/neshaps/subpartw/rulemaking-activity.html. Mary Clark also indicated that there are no existing heap leach piles to which a proposed rule would apply. No additional details regarding the rule were provided.

Name of action: **Proposed Rulemaking for 40 CFR Part 192: Amendments to Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings**

RIN Number: 2060-AP43

EPA Office originating action: OAR

Brief description of action and statement of need for the action:

Atomic Energy Act* rulemaking proposes ground water protection requirements specific to *in-situ* uranium recovery (ISR) facilities. ISR, which uses chemical solutions to alter ground water chemistry and liberate uranium, is now the dominant form of uranium production in the U.S., and presents a direct threat to ground water quality. These standards, issued in 1983, were developed primarily to address conventional mills and mill tailings sites, and are not well-suited to some aspects unique to ISR sites. The proposed standards will address ground water monitoring during the pre-operational, operational, restoration, and post-restoration phases.

*As amended by the Uranium Mill Tailings Radiation Control Act of 1978

Timetable:

September 2013	Final Agency Review
October 2013	Transmittal to OMB
First Quarter 2014	Publication for comment

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No.

Scientific questions to be addressed and approach:

Issues addressed by an SAB advisory (see below) included establishing baseline ground water characteristics, elements of an appropriate monitoring system, appropriate statistical techniques, approaches for post-restoration ground water monitoring, and determination of long-term stability. EPA's proposal incorporates SAB/RAC advice on these issues.

Plans for scientific analyses and peer review:

The Agency is proposing ground water monitoring requirements for activities that involve geochemical processes. The SAB conducted an advisory of the key technical issues associated with this action in July 2011, and finalized a report of recommendations in February 2012. The Agency has responded to the SAB findings and recommendations, and has incorporated them into technical documentation and rulemaking approach.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Revision of Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In Situ Leaching (2060-AP43)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?	X	
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency	X		
Addresses areas of substantial uncertainties	X		
Involves major environmental risks		X	
Relates to emerging environmental issues	X		
Exhibits a long-term outlook	X		

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

The SAB workgroup recommends that SAB review the scientific and technical basis for the Revision of 40 CFR Part 192--Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In Situ Leaching Processing Facilities (2060-AP43) when details of the proposed rule are available. Although the SAB provided advice to the Agency in 2012 (*Advisory on EPA's draft Technical Report entitled Considerations Related to Post Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites* EPA-SAB-12-2005), this action is still under development and the work group could not determine ,from the limited information provided by the agency, the adequacy of the scientific and technical basis for this

important planned action. The Work Group recommends that the SAB evaluate the proposed rule and at that time determine if commentary is appropriate to provide to the Administrator.

The lack of detail concerning the proposed rule limits assessment of the adequacy of the supporting science.

The EPA plans to review and revise the health and environmental protection standards for uranium and thorium mill tailings and uranium in situ leaching with a particular focus on significant changes in uranium industry extraction technologies and their potential impacts to groundwater. The EPA submitted a draft technical report entitled "Considerations Related to Post-Closure Monitoring of Uranium In-Situ Leach/In-Situ Recovery (ISL/ISR) Sites" to the EPA SAB RAC in June 2011 and requested SAB recommendations regarding the technical aspects of designing and implementing the groundwater monitoring networks at ISL uranium mines. The SAB recommended on February 17, 2012 (http://yosemite.epa.gov/sab/sabproduct.nsf/964968D9229863A0852579A7006EC71A/$File/EPA-SAB-12-005-unsigned.pdf) that the EPA expand greatly the draft technical report "so that it is protective and realistic in guiding the monitoring program and evaluating its results" and provided specific recommendations. In June 2012, the EPA provided summary responses (http://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/964968D9229863A0852579A7006EC71A/$File/EPA-SAB-12-005_Response_06-12-2012.pdf) to the SAB's recommendations.

Summary discussion with Agency

The SAB Work Group had a conference call on September 26, 2013 with Mary Clark (Science Advisor Office of Radiation and Indoor Air) and Alan Perrin (Deputy Director, Radiation and Protection Division, ORIA) to collect additional information about the planned action. Mary Clark indicated that the EPA has further considered the RAC's recommendations and have incorporated the relevant recommendations into the technical support for the proposed rule. Additional details regarding the technical support information were not provided.

Name of action: Implementation Rule for 2012 PM2.5 NAAQS (SAN 5477)

RIN Number: 2060-AQ48

EPA Office originating action: Office of Air and Radiation

Brief description of action and statement of need for the action: This proposed rule will address a range of implementation requirements for the 2012 National Ambient Air Quality Standards (NAAQS) for PM2.5. The requirements expected to be addressed in this rule include the timing of State Implementation Plan submissions, the attainment deadlines for areas designated nonattainment, PM2.5 precursor policies, and requirements pertaining to attainment demonstrations, emission inventories, reasonably available control technology, reasonably available control measures, best available control measures, reasonable further progress, mid-course reviews, and contingency measures.

Timetable:

- Detailed Analytical Blueprint and Options Selection Meeting – August 2013
- Proposal date – February 2014

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No

Scientific questions to be addressed and approach:

None. This rule will provide states with EPA's policy on how to comply with Clean Air Act statutory requirements for those areas designated as nonattainment for the 2012 NAAQS.

Plans for scientific analyses and peer review:

None

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Implementation Rule for 2012 PM2.5 NAAQS (2060-AQ48)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?	X	
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			X
Addresses areas of substantial uncertainties			X
Involves major environmental risks			X
Relates to emerging environmental issues			X
Exhibits a long-term outlook		X	

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This action does not merit further SAB consideration.

The implementation rule is largely an administrative rule pertaining to factors such as timing of State Implementation Plan submissions, the attainment deadlines for areas designated nonattainment, PM2.5 precursor policies, and requirements pertaining to attainment demonstrations, emission inventories, reasonably available control technology, reasonably available control measures, best available control measures, reasonable further progress, mid-course reviews, and contingency measures. As such, this proposed action is not a priority for review by SAB.

Name of action: Greenhouse Gas Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units

RIN Number: 2060-AR33

EPA Office originating action: OAR

Brief description of action and statement of need for the action:

Power plants are the largest concentrated source of emissions in the United States, together accounting for roughly one-third of all domestic greenhouse gas emissions. President Obama's Climate Action Plan, and the June 25, 2013 presidential memorandum on power sector carbon pollution standards, direct EPA to take several actions to reduce greenhouse gas emissions from power plants. These actions include proposing, and then finalizing, greenhouse gas emission guidelines for existing power plants. EPA plans to establish greenhouse emission guidelines for existing electric utility generating units (EGUs) under the authority of section 111 of the Clean Air Act.

Timetable:

EPA plans to issue proposed greenhouse gas emission guidelines for existing EGUs by June 1, 2014, and then issue final emission guidelines by June 1, 2015.

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

This action does not rely on new science. The action will rely on the identification of existing, proven technologies to set achievable emission standards that, by statute, offer the "best system of emission reduction" (BSER).

Scientific questions to be addressed and approach:

This is a technology based rule (as described above).

Plans for scientific analyses and peer review:

See description above.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Greenhouse Gas New Source Performance Standard for Electric Generating Units-Emissions Guidelines for Existing Sources (2060-AR33)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency	X		
Addresses areas of substantial uncertainties	X		
Involves major environmental risks	X		
Relates to emerging environmental issues	X		
Exhibits a long-term outlook		X	

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This planned action should not be considered for review by the SAB.

The planned action involves amending performance standards by adding greenhouse gas emissions to existing Electric Generating Units (EGUs) and is tied to Executive Order 13211. In the fact finding teleconference on September 26, 2013, the EPA staff noted that this planned action, will not advance the technical and scientific requirements. EPA anticipates that the planned action will develop the best approaches that are reasonable to ask states to implement. EPA stated that demand management may be a focus of utilities in meeting this planned action's

standards. If this is the case, the Work Group agrees that there may not be major scientific approaches being applied to the problem that are new to the agency.

The EPA is conducting stakeholder listening sessions to discuss the planned action and has not yet developed the options for this planned action. The EPA is evaluating many approaches and options at this stage of the rulemaking process. The planned action for existing sources will need to consider different approaches than the new source proposal. At this time carbon capture and storage (CCS) may not be a feasible technology across the spectrum of electricity generating units. While feasible in new plants EPA does not anticipate application of this technology across all plants.

EPA staff also noted that they are also evaluating power sector modeling results and these models are peer reviewed. Staff also explained that assumptions used in the model formulation have been peer reviewed. In addition to the power sector modeling, EPA staff cited technology data from the Energy Information Agency and Department of Energy are being considered. In addition to the peer review that Integrated Planning Model has undergone, EPA staff participate in the Stanford Energy Modeling Forum where results from EPA"s power sector models are compared to results from other models developed by industry and academia.

Specific technical and scientific matters identified by the Work Group that the SAB may also want to consider are:

- Scientific and technical lessons learned from the establishment of Clean Air Act Section 111(d) emissions standards for other regulated emissions (e.g., acid mist, fluorides, total reduced sulfur, landfill gases) while recognizing that carbon pollution emissions differ from these other pollutants in scope (global), magnitude (> 10x), and atmospheric biogeochemical cycling.
- The scientific and technical assumptions used by States to set standards under Section 111(d) of the Clean Air Act; specifically around descriptions of "Best Systems of Emission reductions (BSERS)", degree of emission limitations achievable, time to implementation, and emission reduction goals (or "standards of performance" under the BSER.
- The commonality of State carbon pollution emissions technological controls and underlying scientific assumptions around emissions (under their existing climate and energy policies).
- Methods to understand scientific and technical commonality around source-based and system-based emissions across the States.
- Scientific and technical basis for State-based supply-side and demand-side control options.

Name of action: Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units

RIN Number: 2060-AQ91

EPA Office originating action: OAR

Brief description of action and statement of need for the action:

Power plants are the largest concentrated source of emissions in the United States, together accounting for roughly one-third of all domestic greenhouse gas emissions. President Obama's Climate Action Plan, and the June 25, 2013 presidential memorandum on power sector carbon pollution standards, direct EPA to take several actions to reduce greenhouse gas emissions from power plants. One of these is to propose, and then finalize, carbon pollution standards for new power plants. In this action, EPA plans to establish new source performance standards (NSPS) for new electric utility generating units (EGUs) under the authority of section 111 of the Clean Air Act.

Timetable:

EPA intends to issue new proposed carbon pollution standards by September 20, 2013, and final standards within one year of publication of the proposal.

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

This action does not rely on new science. This action will rely on the identification of existing, proven technologies to set achievable emission standards that, by statute, offer the "best system of emission reduction" (BSER).

Scientific questions to be addressed and approach:

This is a technology based rule (as described above).

Plans for scientific analyses and peer review:

See description above.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generation Units (AQ91)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		**X**
Is the action primarily administrative (i.e., involve reporting or record keeping)?		**X**
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		**X**
Is the action an extension of an existing initiative?		**X**

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency	**X**		
Addresses areas of substantial uncertainties	**X**		
Involves major environmental risks	**X**		
Relates to emerging environmental issues	**X**		
Exhibits a long-term outlook		**X**	

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

The SAB Work Group recommends that the SAB review The Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generation Units (2060-AQ91). This action involves development of new performance standards for greenhouse gas emissions (CO_2) from new Electric Utility Generation Units (EGUs) under new source performance rules. The SAB should consider this action[1] for review because: (1) the Work Group could not determine, from the information provided by the Agency, whether there was an adequate scientific and technological basis for the proposed provisions to achieve emissions

[1] Administrator McCarthy signed the proposed Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generation Units on September 20, 2013.

reductions in coal-fueled EGUs and (2) based on information provided to the Work Group, whether the peer review of the scientific and technical information supporting the action appears to be inadequate.

The Agency's expectation is that new power plants will utilize natural gas combined cycle technology to implement this proposal. The EPA considered industry trends, available technology, and best systems of emission reduction to develop the proposal. The Agency concludes that the proposed standard will not be technology forcing for such plants.

In the fact-finding call held on September 26, 2013, the EPA Staff explained that should new EGUs not utilize natural gas and opt for coal as a fuel source, these new coal plants will need to implement new carbon capture and storage (CCS) technologies to meet the standards. The EPA is identifying partial CCS as a viable technology for new efficient coal units that would meet the criteria of the best system of emission reduction (BSER) for implementation of the proposed standards. In setting BSERs, the EPA considers the standard and whether: the system is technically feasible; the costs are reasonable; the amount of emissions achieved by the technology meets the standard; and does the proposal promotes the implementation and further development of a technology.

EPA Staff explained that the CCS provisions are based on three examples of implementing partial CCS and the strong demonstration these facilities make for the technology (See Attachment C). They stated that this proposal relies on existing sequestration studies and reporting requirements for carbon capture and does not anticipate additional research. The Work Group finds that the scientific and technical bases for carbon storage provisions are new science and the rulemaking would benefit from SAB review.

The Work Group also finds that there may be specific new science and technology related to the understanding of CCS and BSERs for coal-fired or integrated gasification and combined cycle EGUs, but not natural gas combined cycle EGUs. The SAB review could assess: 1) the EPA assumptions regarding the status of CCS technology; 2) the possible/probable development path of CCS technologies; and 3) implications for performance and cost of these types of technologies applied to coal combustion and integrated gasification and combined cycle plants.

The EPA Staff cited Department of Energy National Energy Technology Laboratory (NETL) studies as well as existing EGUs under construction and in advanced stages of development as the basis for the BSER assumptions for new natural gas and coal fuel sources for new EGUs. EPA staff explained that the NETL studies are all peer reviewed and EPA did not conduct additional peer review(s).

The SAB Staff requested additional information on the technological basis and peer review for the action from OAR and NETL. OAR Staff notes that the EPA relied on information NETL released in a series of reports on the '*Cost and Performance Baselines for Fossil Energy Plants*." The studies were conducted to establish estimates for the cost and performance of combustion and gasification based power plants as well as options for co-generating synthetic natural gas and fuels, all with and without carbon dioxide capture and storage. Volume 1 of these

studies explains that …"[t]he initial results of this analysis were subjected to a significant peer review by industry experts, academia and government research and regulatory agencies." [2]

NETL Staff responded that "reviewers were sent the report and given several weeks for review and the regulatory agency that provided the review was the EPA." NETL noted that this peer review process was specifically tailored for this report and NETL does not have a publically-available description of the review. NETL staff also notes that all the information presented for coal-fueled sources was not peer reviewed.[3]

The Work Group finds that the peer review of the scientific and technical information supporting the action information appears to be inadequate.

[2] Volume 1 of the series – "Cost and Performance Baseline for Fossil Energy Power Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity" (and subsequent updates) – available at http://www.netl.doe.gov/energy-analyses/baseline_studies.html

[3] August 2011 report "Cost and Performance of PC and IGCC Plants for a Range of Carbon Dioxide Capture" which modified the CO_2 capture rates for select cases presented in the "Cost and Performance Baseline for Fossil Energy Plants" did not undergo peer review. That report can be found here: http://www.netl.doe.gov/energy-analyses/refshelf/PubDetails.aspx?Action=View&PubId=396

OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

Name of action: Pesticides; Agricultural Worker Protection Standard Revisions (40 CFR 170)

RIN Number: 2070-AJ22

EPA Office originating action: OCSPP/OPP

Brief description of action and statement of need for the action:

EPA is developing a proposal under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) to revise the federal regulations that direct agricultural worker protection (40 CFR 170). The changes under consideration are intended to improve agricultural workers' ability to protect themselves from potential exposure to pesticides and pesticide residues. In addition, EPA is proposing to make adjustments to improve and clarify current requirements and facilitate enforcement. Other changes sought are to bring hazard communication requirements more in line with Occupational Safety and Health Administration requirements and make improvements to pesticide safety training, with improved worker safety the intended outcome. The potential need for change arose from EPA discussions with key stakeholders beginning in 1996 and continuing through 2004. EPA held nine public meetings throughout the country during which the public submitted written and verbal comments on issues of their concern. In 2000 through 2004, EPA held meetings where invited stakeholders identified their issues and concerns with the regulations.

Timetable:

Applicable Deadlines: None

Regulatory Agenda: NPRM 02/00/2014

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

No.

Scientific questions to be addressed and approach:

N/A.

Plans for scientific analyses and peer review:

Science Advisory Panel (FIFRA Sec. 25(d)) waived review on 2/20/2013.

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Pesticides; Agricultural Worker Protection Standard Revisions (2070-AJ22)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		**X***
Is the action primarily administrative (i.e., involve reporting or record keeping)?	**X**	
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		**X**
Is the action an extension of an existing initiative?	**X**	

*The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel (SAP) waived review on 2/20/2013. Members are listed here: http://www.epa.gov/scipoly/sap/members.htm

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency		**x**	
Addresses areas of substantial uncertainties		**x**	
Involves major environmental risks		**x**	
Relates to emerging environmental issues			**x**
Exhibits a long-term outlook			**x**

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This action does not merit further SAB consideration. EPA is developing a proposal under the Federal Insecticide, Fungicide and Rodenticide Act to revise the federal regulations that direct agricultural worker protection (40 CFR 170). The changes under consideration are intended to improve agricultural workers' ability to protect themselves from potential exposure to pesticides and pesticide residues. EPA is also proposing to make adjustments to improve and clarify current requirements and facilitate enforcement. Other changes sought are to bring hazard communication requirements more in line with Occupational Safety and Health Administration

requirements and make improvements to pesticide safety training, with improved worker safety the intended outcome. The potential need for change arose from EPA discussions with key stakeholders beginning in 1996 and continuing through 2004. EPA held nine public meetings throughout the country during which the public submitted written and verbal comments on issues of their concern. In 2000 through 2004, EPA held meetings where invited stakeholders identified their issues and concerns with the regulations.

Name of action: PCB Use Authorizations

RIN Number: 2070-AJ38

EPA Office originating action: Office of Chemical Safety and Pollution Prevention

Brief description of action and statement of need for the action: EPA's regulations governing the use of Polychlorinated Biphenyls (PCBs) in electrical equipment and other applications have not been updated since 1998. EPA has initiated rulemaking to reassess the ongoing authorized uses of PCBs to determine whether certain use authorizations should be ended or phased out because they can no longer be justified under section 6(e) of the Toxic Substances Control Act, which requires that the authorized use will not present an unreasonable risk of injury to health and the environment. As the first step in this reassessment, EPA published an Advanced Notice of Proposed Rulemaking (ANPRM) on April 7, 2010 and took comment through August 20, 2010. EPA reviewed and considered all comments received on the ANPRM in planning the current rulemaking. This action will address the following specific areas: (1) the use, distribution in commerce, marking and storage for reuse of liquid PCBs in electric equipment; (2) improvements to the existing use authorization for natural gas pipelines; and (3) definitional and other regulatory "fixes." The reassessment of use authorizations related to liquid PCBs in equipment will focus on small capacitors in fluorescent light ballasts, large capacitors, transformers and other electrical equipment. In addition, revised testing, characterization, and reporting requirements for PCBs in natural gas pipeline systems to provide more transparency for the Agency and the public when PCB releases occur will be considered. Consistent with Executive Order 13563, "Improving Regulation and Regulatory Review," wherever possible and consistent with the overall objectives of this rulemaking, the Agency will also eliminate or fix regulatory inefficiencies noted by the Agency or in public comments on the ANPRM.

Timetable:

Applicable Deadlines: None
Regulatory Agenda: NPRM publication: 07/00/2014 (Designated as a Long-Term action)

Does the action rely on science that meets the EPA *Peer Review Handbook* definition of "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"

As per the Agency's Peer Review Handbook, none of the analyses proposed are expected to require external peer review. Generally all influential scientific and technical work products used in decision making should be peer reviewed. The process of determining whether a supporting scientific and/or technical work product is "influential" takes into account circumstances surrounding the use of the work product. The Agency's Peer Review handbook provides that "the novelty or controversy associated with the work product may determine whether it is influential scientific information. Influential scientific information may be novel or innovative, precedential, controversial, or emerging ('cutting edge')." PCBs have well established and thoroughly studied adverse health effects in both humans and wildlife, with studies dating back to 1937. The scientific work products associated with this action are not expected to present any novel or controversial issues necessitating external peer review.

Scientific questions to be addressed and approach:

N/A

Plans for scientific analyses and peer review:

N/A

Recommendation from the SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science

Name of planned action: Polychlorinated Biphenyls (PCBs); Reassessment of Use Authorizations (2070-AJ38)

Please respond to the following questions based on the short description EPA provided for the planned action.

	Yes	No
Is the action planned or under review by the SAB? If not, has EPA identified other high-level external peer review (i.e., by the NAS, CASAC, or FIFRA SAP)?		X
Is the action primarily administrative (i.e., involve reporting or record keeping)?		X
Has EPA characterized the action as one that has "an influential scientific or technical work product" that "has a major impact, involves precedential, novel, and/or controversial issues, or the Agency has a legal and/or statutory obligation to conduct a peer review?"		X
Is the action an extension of an existing initiative?	X	

Please indicate whether the action merits a high, medium or low level of interest regarding the following historical SAB science- and problem-driven criteria, based on the short description EPA provided for the planned action.

	High	Medium	Low
Involves scientific approaches that are new to the agency			x
Addresses areas of substantial uncertainties			x
Involves major environmental risks		x	
Relates to emerging environmental issues			x
Exhibits a long-term outlook			x

Please provide a recommendation regarding whether the SAB should consider this action for review and comment on the adequacy of the supporting science and provide a brief rationale.

This action does not merit further SAB consideration. EPA's regulations governing the use of polychlorinated biphenyls (PCBs) in electrical equipment and other applications have not been updated since 1998. EPA has initiated rulemaking to reassess the ongoing authorized uses of PCBs to determine whether certain use authorizations should be ended or phased out because they can no longer be justified under section 6(e) of TSCA, which requires that the authorized use will not present an unreasonable risk of injury to health and the environment. OCSPP confirmed that this action will address the following specific areas: (1) the use, distribution in commerce, marking and storage for reuse of liquid PCBs in electric equipment; (2)

improvements to the existing use authorization for natural gas pipelines; and (3) definitional and other regulatory fixes. OCSPP confirms that the proposed rule will only address the following specific areas of PCB use: (1) the use, distribution in commerce, marking and storage for reuse of liquid PCBs in electric equipment; (2) improvements to the existing use authorization for natural gas pipelines; and (3) definitional and other regulatory "fixes."

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States

House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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Strengthening Transparency and Accountability within the Environmental Protection Agency

Thursday, November 14, 2013
10:00 a.m. – 1:00 p.m.
2318 Rayburn House Office Building

Witnesses

The Honorable Gina McCarthy, Administrator, Environmental Protection Agency

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HEARING CHARTER

Strengthening Transparency and Accountability
within the Environmental Protection Agency

Thursday, November 14, 2013
10:00 a.m. to 1:00 p.m.
2318 Rayburn House Office Building

PURPOSE

On Thursday, November 14, 2013 at 10:00 a.m. the House Committee on Science, Space, and Technology will hold a hearing to review science and technology activities at the Environmental Protection Agency (EPA) including: agency-wide policies and practices related to the development and use of science in regulatory decisions; the role of independent scientific advisory bodies such as the EPA Science Advisory Board and the EPA Clean Air Scientific Advisory Committee; and the importance of transparency and integrity in the Agency's science activities.

WITNESS LIST

The Honorable Gina McCarthy, Administrator, U.S. Environmental Protection Agency

BACKGROUND

Science has been central to EPA's mission and functions since its establishment in 1970. In his message to Congress regarding the creation of EPA, President Nixon stated that a principal role of the agency should be "[t]he conduct of research on the adverse effects of pollution and on methods and equipment for controlling it, the gathering of information on pollution, and the use of this information in strengthening environmental protection programs and recommending policy changes."[1]

Today, with significantly expanded regulatory authorities and a budget over $8 billion, science remains an important component of the agency's mission and core activities. EPA's policy on scientific integrity states:

> "Science is the backbone of the EPA's decision-making. The Agency's ability to pursue its mission to protect human health and the environment depends upon the integrity of the science on which it relies. The environmental policies, decisions, guidance, and regulations that impact the lives of all Americans every day must be grounded, at a most fundamental level, in sound, high quality science."[2]

[1] http://www.epa.gov/aboutepa/history/org/origins/reorg.html
[2] http://www.epa.gov/osa/pdfs/epa_scientific_integrity_policy_20120115.pdf

EPA Administrator Gina McCarthy echoed this priority in her confirmation hearing, stating that "The rule of law, along with sound science and transparency, is one of EPA's core values and, if I am confirmed, it will continue to guide all EPA actions."[3] Similarly, she stated that, "EPA is committed to transparency with regard to the scientific bases of agency decision making."[4]

Overview of EPA Science Activities and Organization

EPA's science-related authorities and activities are derived from a number of statutes. The Environmental Research, Development, and Demonstration Authorization Act (ERDDA) authorizes agency research and science activities broadly, and created the Office of Research and Development (ORD) and Science Advisory Board (SAB).

In addition to ERDDAA, EPA also derives authority for R&D activities through other major environmental statutes. For example, under the Clean Air Act, the EPA Administrator must issue air quality criteria that "shall accurately reflect the latest scientific knowledge useful in indicating the kind of extent of all identifiable effects on public health or welfare which may be expected from the presence of such pollutant in the ambient air."[5] Through the Safe Drinking Water Act, EPA sets standards based on "the best available, peer-reviewed science and supporting studies conducted in accordance with sound and objective scientific practices."[6] Similarly, the Clean Water Act requires EPA to publish water quality information "accurately reflecting the latest scientific knowledge."[7]

The science enterprise at EPA is spread across program offices and regions. ORD is organized into three national labs comprised of 18 separate labs and four national centers with 19 divisions. In addition to 18 labs within ORD, there are nine labs split among several program offices and each of EPA's ten regions across the nation has its own lab.

In a 2012 report, the SAB and EPA's Board of Scientific Counselors (BOSC) stated: "Over 6,000 EPA employees are involved in scientific assessments, research, and related activities, with approximately 1,300 full-time scientific staff in the Office of Research and Development (ORD) and approximately 4,700 full-time scientific staff in program and regional offices."[8]

The fragmented, disparate nature of EPA R&D presents a challenge to manage and coordinate, and has complicated efforts to evaluate the effectiveness of these activities. Numerous studies conducted by the Office of Inspector General (OIG), the Government Accountability Office (GAO), the National Academies of Science (NAS) and other outside

[3] http://www.epw.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_id=d71fd4b6-ce77-3a98-46a0-fb02b0cae0ed
[4] Ibid.
[5] 42 U.S.C. §7408 (a)(2) (2000).
[6] 42 U.S.C. §300g-1(b)(3)(A)(i).
[7] 33 U.S.C. §1314 (a)(1).
[8] EPA Science Advisory Board and Board of Scientific Counselors, Science *Integration for Decision Making at the U.S. EPA*, July 6, 2012.

groups over the years have cited significant concerns with the EPA's SAB and the difficulties in evaluating the usefulness of the science to program needs.

ISSUES FOR CONSIDERATION

Through the years, a series of reports have documented problems with science at EPA, including a lack of uniformity of the peer-review process, not evaluating impacts of regulations and a lack of transparency. In 1992, an independent panel stated, "Currently, EPA science is of uneven quality, and the Agency's policies and regulations are frequently perceived as lacking a strong scientific foundation."[9] Beyond the actual science conducted at the Agency, and used to generate regulations, the perception of the public is that EPA does not use science in an effective manner. "A perception exists that regulation based on unsound science have led to unneeded economic and social burdens, and that unsound science has sometimes led to decisions that expose people and ecosystems to avoidable risks."[10]

Regulatory Science

Science plays a foundational but not necessarily determinative role in support of EPA's mission to protect human health and the environment. EPA states that "the role and use of science at EPA are determined by the nature of the scientific information and how it fits with the context of Agency decision-making."[11] This role is further elaborated upon as follows:

> Science does not drive EPA's policy and regulatory decisions, but rather, along with other relevant factors, informs and supports those decisions. Implementation costs and technological feasibility, local autonomy versus federal control, and justice and equity--all of which impact our quality of life and standard of living--are among the considerations that need to be factored into EPA's decisions without compromising scientific integrity, the Agency's mission, or statutory mandates. The impacts or limitations of these non-science factors, as well as the current state-of-the-science, will influence how scientific considerations are brought to bear on a particular environmental problem facing the Agency.[12]

Numerous entities have raised concerns regarding possible shortcomings in the quality and use of science at the agency. The FY2013 Annual Plan of the EPA's OIG raises concerns about science and technology activities at the Agency, stating that "[q]uestions exist as to whether EPA is collecting the right data, of sufficient quality, and is making that data available."[13] In terms of EPA's regulatory process, the OIG further stated that "[m]any policies are out of date or are based on outdated science and technology."[14] More broadly, the chair of a 2009 National Academy of Sciences panel on ways to improve the Agency's risk assessment process told the EPA's SAB and BOSC earlier this year that the "The sleeping giant is that EPA

[9] EPA, *Safeguarding the Future: Credible Science, Credible Decisions,* 1992.
[10] Ibid.
[11] http://www.epa.gov/epahome/science.htm
[12] Ibid.
[13] EPA Inspector General (IG), "FY 2013 Annual Plan," January 2013, http://www.epa.gov/oig/reports/2013/EPA_OIG_FY_2013_Annual_Plan.pdf
[14] Ibid.

science is on the rocks," and that risk assessment process was the Agency's "Achilles heel."[15] Their final report found that, "There is a critical need for more high quality assessments translating existing science on a broad range of topics important to decision making at the EPA," and "narrow interpretations of legislative mandates and the organizational structure of EPA's regulatory programs often have posed barriers to innovation and cross-program solving."[16]

Peer Review and Advisory Panels

EPA's Peer Review Handbook provides guidance to the agency regarding use of peer review to enhance the quality and objectivity of scientific or technical work products. Specifically, EPA's peer review policy "encourages and expects peer review of all scientific and technical information that is intended to inform or support Agency decisions and notes that influential scientific information, including highly influential scientific assessments, should be peer reviewed in accordance with this Handbook."[17]

The EPA OIG released the report "*Procedural Review of EPA's Greenhouse Gases Endangerment Finding Data Quality Processes,*" which raised a number of concerns about how the Agency classifies scientific assessments and information, as well as the quality of peer review that EPA science undergoes. In reviewing EPA's Technical Support Document (TSD) in support of the Endangerment Finding, the OIG found that:

> "EPA's peer review did not meet all OMB [Office of Management and Budget] requirements for such documents. EPA had the TSD reviewed by a panel of 12 federal climate change scientists. However, the panel's findings and EPA's disposition of the findings were not made available to the public as would be required for reviews of highly influential scientific assessments. Also, this panel did not fully meet the independence requirements for reviews of highly influential scientific assessments because one of the panelists was an EPA employee."[18]

With respect to advisory panels, concerns have been raised regarding the make-up, transparency, and rigor provided by EPA advisory panels such as SAB and CASAC. Despite the requirement under the Federal Advisory Committee Act that panels be "fairly balanced in terms of points of view presented and the functions to be performed by the advisory committee,"[19] GAO has found that "[m]any advisory committee members are not appropriately screened for potential conflicts of interest or points of view."[20]

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[15] *Inside EPA*, "Key Adviser Warns EPA to Improve Agency Science Or Face A 'Crisis'," July 6, 2011.
[16] EPA Science Advisory Board and Board of Scientific Counselors, *Science Integration for Decision Making at the U.S. EPA*, July 6, 2012.
[17] http://www.epa.gov/peerreview/pdfs/peer_review_handbook_2006.pdf
[18] EPA IG, "Procedural Review of EPA's Greenhouse Gases Endangerment Finding Data Quality Processes," Report No. 11-P-0702, September 26, 2011, http://www.epa.gov/oig/reports/2011/20110926-11-P-0702.pdf.
[19] 5 U.S.C. App
[20] GAO, "Ensuring Sound Science." See also: John Stephenson, GAO, Testimony before the Committee on Environment and Public Works, U.S. Senate, "SCIENTIFIC INTEGRITY: EPA's Efforts to Enhance the Credibility and Transparency of Its Scientific Processes," June 9, 2009, http://www.gao.gov/products/GAO-09-773T.

Cost-Benefit Analysis

EPA regulations are playing a greater role in the overall costs and benefits to the American economy. In its *Draft 2013 Report to Congress on the Benefits and Costs of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities*,[21] the Office of Information and Regulatory Affairs notes the prominence of EPA Clean Air Act rules in the overall regulatory apparatus, saying that EPA rules represent 58 to 80 percent of the agency-estimated monetized benefits and 44 to 54 percent of the monetized costs of all federal regulations.

Risk Assessment and Communication

Another major EPA responsibility within the Science, Space, and Technology Committee's jurisdiction is the conduct of risk assessments. EPA efforts in risk assessment aim to "characterize the nature and magnitude of health risks to humans (e.g., residents, workers, recreational visitors) and ecological receptors (e.g., birds, fish, wildlife) from chemical contaminants and other stressors that may be present in the environment."[22] EPA's primary program for assessing human health risks is known as the Integrated Risk Information System (IRIS).

The National Research Council (NRC) recently noted that as the science of risk assessment has become more complex, "improved analytical techniques have produced more data that lead to question about how to address issues of, for example, multiple chemical exposures, multiple risks and susceptibility in populations."[23] Despite understanding the increasing complexity and greater need for data and information, chemical risk assessment at EPA remains on GAO's High-Risk Program and was targeted for reform in the Consolidated Appropriations Act of 2012. Additionally, a 2011 NRC report made specific recommendations to EPA regarding how best to improve the IRIS process:[24]

[21] http://www.whitehouse.gov/sites/default/files/omb/inforeg/2013_cb/draft_2013_cost_benefit_report.pdf.
[22] http://epa.gov/riskassessment/basicinformation.htm#arisk
[23] NRC, *Science and Decisions: Advancing Risk Assessment*, 2009
[24] http://www.nap.edu/catalog.php?record_id=13142

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
CHAIRMAN LAMAR SMITH

For Immediate Release
November 14, 2013

Media Contacts: Kim Smith Hicks, Zachary Kurz
(202) 225-6371

Statement of Chairman Lamar Smith (R-Texas)
Hearing on Strengthening Transparency and Accountability at the EPA

Chairman Smith: The Environmental Protection Agency (EPA), like every other governmental institution, answers to the American people. Everyone agrees that we need to protect the environment, but we should do so in a way that is open and honest. Democracy requires transparency and accountability.

Yet EPA's justifications for its regulations are cloaked in secret science. It appears the EPA bends the law and stretches the science to justify its own objectives.

The Americans impacted by the Agency's regulations have a right to see the data and determine for themselves independently if these regulations are based on sound science or a partisan agenda. The EPA's efforts to expand its regulatory reach across the U.S. represent a troubling trend.

For example, take EPA's current attempt to redefine its jurisdiction under the Clean Water Act. It seeks to expand the definition of "Waters of the U.S." to give the Agency unprecedented new authority over private property.

According to media reports, this expansion of EPA regulatory power could include almost all man-made and natural streams, lakes and ponds in the U.S. This undermines states' rights and increases federal control of private property and could lead to the EPA telling us what to do in our own back yard.

The EPA's efforts to demonize hydraulic fracturing are another example of an Agency implementing a partisan agenda before it takes the time to get the facts. The EPA made wild claims of groundwater contamination, but was forced to retract those claims when it could produce no evidence. Perhaps the most outrageous examples of the Agency's disregard for transparency and accountability are found in the EPA's clean air program.

We all agree that ensuring clean air is essential, but the EPA has a responsibility to establish rules that balance our environmental concerns and our economic needs.

Nearly all of this Administration's air quality regulations are justified on the basis of hidden data. These regulations cost billions of dollars but the EPA claims that the benefits of these rules justify the costs. These claims can't be verified if the EPA uses secret science.

More than two years ago, before this Committee, then Assistant Administrator McCarthy said this information was available for independent review and verification. And a few months ago, the President's own Science Advisor took the same position.

When the EPA failed to live up to those commitments, the Committee issued a subpoena requiring the Agency to produce the data. Three months later, the Agency still hasn't provided the data necessary to verify the Agency's claims.

Let me be clear: It is the EPA's responsibility to ensure that the science it uses is transparent and that its claims can be verified by the public.

Recently, the EPA provided us with copies of letters it received from scientists explaining why they believe this data cannot be released to the public. It's unfortunate that it took us two years and a subpoena to get here, but now even the EPA knows the truth: the Agency itself cannot publicly verify its own claims.

So not only do we have a lack of transparency, we have an Agency that is regulating with reckless abandon and without the facts to back up its claims.

We need to know whether the Agency is telling the truth to the American people. The EPA must either make the data public, or commit to no longer use secret science to support its regulations. Without this, Congress will have no choice but to prohibit the EPA's use of secret data moving forward.

I will introduce legislation in the next few weeks that will stop the EPA from basing regulations on undisclosed and unverified information.

We can and should continue to look for ways to protect our environment. But these efforts must be open, transparent and based on sound science. Only then can the American people decide whether the costs of EPA's regulatory agenda is supported by the facts.

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Opening Statement – Ranking Member Eddie Bernice Johnson (D-TX)
Ranking Member, House Committee on Science, Space, and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency
November 14, 2013

Good morning. I am very pleased to welcome Administrator McCarthy to today's hearing. She had a distinguished record at the Environmental Protection Agency prior to her being selected to be EPA Administrator, and by all accounts she has been doing an exemplary job since assuming that position.

While I think her record of performance and her integrity speak for themselves, I thought it important to review the mission.

First the mission of the EPA is to *"protect human health and the environment."* As someone who worked in public health before I entered politics, I can think of no mission of the federal government that is more important or noble than that. As a Member of Congress I think I should be doing all that I can to encourage EPA as it attempts to carry out a very challenging mission. I think, too often EPA is made a target for funding cuts and its leadership subjected to harassment and denigration. Unfortunately, our own Committee has not been immune from employing such tactics.

Mr. Chairman, I am a Texan from birth to death, and I'm no stranger to the oil and gas industries and the economic benefits they can bring—or to the pollution and health and environmental impacts those industries can also bring. I know that EPA's actions have consequences for companies that sometimes are negative. However, I also know that EPA's actions have important consequences for the health of our constituents—especially those who are young, infirm, or elderly. And those consequences have been very positive indeed over the forty-odd years that EPA has been in existence. We all want a healthy economy, but we also want a healthy quality of life for our citizenry—and EPA's efforts have played a critical role in achieving both those goals since its inception.

As Members of Congress, I think we should be strive to educate our constituents, not scare them. I hope today I can resist the temptation to try for provocative "sound bites" for my district, and instead use today's hearing to better understand what EPA has been tasked to accomplish, how it is doing on those tasks, and how we in Congress can help it to do its job more effectively.

Administrator McCarthy, I know you have a very tough job, and I want to commend you for your willingness to take it on in spite of all the hurdles that you and your agency face. I look forward to your testimony, and I look forward to working with you to help EPA achieve the goals that the nation has asked us to carry out.

SST Full Committee Hearing
Strengthening Transparency and Accountability
within the Environmental Protection Agency
Congresswoman Elizabeth H. Esty Statement for the Record
November 14, 2013

Thank you Chairman Smith and Ranking Member Johnson for holding today's hearing on the Environmental Protection Agency.

I am also pleased to welcome Administrator Gina McCarthy. Administrator McCarthy served as the Commissioner of the Connecticut Department of Environmental Protection and then as an Assistant Administrator of the United States EPA.

Administrator McCarthy, it is wonderful to see you again. Congratulations on your confirmation. You have an important role and responsibility as the head of the agency charged with protecting the environment and the public, and I appreciate all your hard work to that end.

In Connecticut we have seen firsthand the devastation of climate change. Last year Hurricane Sandy wreaked havoc, killing 285 people. According to FEMA, more than 23,000 people were temporarily displaced from their homes, and more than 8.5 million people lost power. As we continue to recover from the storm, we should be looking for ways to work together on commonsense solutions with the EPA to guard against future harms from superstorms that are becoming all too common in the wake of climate change.

Furthermore, the International Energy Agency announced earlier this week that the United States will become the world's top oil producer by 2015, and our country is estimated to be self-sufficient from an energy perspective in the next two decades. As we work to achieve energy independence, it is important that we work with the EPA to ensure safe and effective oil and gas exploration and production.

I am hopeful that Congress and the Environmental Protection Agency can work together to protect and support our citizens and our environment.

TESTIMONY OF
GINA MCCARTHY
ADMINISTRATOR
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

November 14, 2013

Good morning Chairman Smith, Ranking Member Johnson, and other distinguished members of the Committee. I am pleased to be here to talk about the central role science plays at the U.S. Environmental Protection Agency.

Let me begin by stating that science is and has always been the backbone of the EPA's decision-making. The Agency's ability to pursue its mission to protect human health and the environment depends upon the integrity of the science upon which it relies. I firmly believe that environmental policies, decisions, guidance, and regulations that impact the lives of all Americans must be grounded, at a most fundamental level, in sound, high quality, transparent, science.

Because we rely so heavily on science to meet our mission on behalf of the American people, it must be conducted in ways that are transparent, free from bias and conflicts of interest, and of the highest quality, integrity, and credibility. These qualities are important not just within our own organization and the federal government, but across the scientific community, with its long established and highly honorable commitment to maintaining strict adherence to ethical investigation and research. That's why the agency has established—and embraced—a Scientific

Integrity Policy[1] that builds upon existing Agency and government-wide policies and guidance documents, explicitly outlining the EPA's commitment to the highest standards of scientific integrity. And that commitment extends to any scientist or organization who wishes to contribute to our efforts. All EPA-funded research projects, whether conducted by EPA scientists or outside grantees and collaborators, must comply with the agency's rigorous quality assurance requirements.

To ensure that we have the best possible science, we are committed to rigorous, independent peer review of the scientific data, models and analyses that support our decisions. Peer review can take a number of forms, ranging from external reviews by the National Academy of Sciences or the EPA's federal advisory committees to contractor-coordinated reviews. Consistent with OMB guidance, we require peer review for all EPA research products and for all influential scientific information and highly influential scientific assessments.

Among the external advisory committees is the EPA Science Advisory Board (SAB). SAB reviews are conducted by groups of independent non-EPA scientists with the range of expertise required for the particular advisory topic. We invite the public to nominate experts for SAB panels and to comment on candidates being considered by the EPA for SAB panels. The EPA evaluates public comments and information submitted about SAB nominees. The EPA reviews experts' confidential financial information to ensure that there are no conflicts of interest.

SAB peer reviews are conducted in public sessions in compliance with the open-government requirements of the Federal Advisory Committee Act. The public is invited to attend and to provide oral and written comments for consideration by the SAB. Public comments help to

[1] http://www.epa.gov/research/htm/scientific-integrity.htm

ensure that all relevant scientific and technical issues are available to the SAB as it reviews the science that will support our environmental decisions.

Another example is the Clean Air Scientific Advisory Committee (CASAC) which provides independent advice to the EPA Administrator on the science that supports the EPA's National Ambient Air Quality Standards. The CASAC reviews the EPA's Integrated Science Assessments which deliver science in support of the Clean Air Act.

Thanks to the science behind the implementation of the Clean Air Act, we have made significant and far-reaching improvements in the health and well-being of the American public. In 2010 alone, EPA estimates that programs implemented pursuant to the Clean Air Act Amendments of 1990 avoided 160,000 premature deaths millions of cases of respiratory problems such as acute bronchitis and asthma attacks; 45,000 cardiovascular hospitalizations; and 41,000 hospital admissions. [2] These improvements have all occurred during a period of economic growth; between1970 and 2012 the Gross Domestic Product increased by 219%.[3]

Through a transparent and open process, we have also committed to enhancing the Agency's Integrated Risk Information System (IRIS) assessment program. A strong, scientifically rigorous IRIS Program is of critical importance, and the EPA is in the process of: 1) enhancing the scientific integrity of assessments; 2) enhancing the productivity of the Program; and 3) increasing transparency so that issues are identified and debated early in the process. In 2009, the EPA made significant enhancements to IRIS by announcing a new 7-step assessment

[2] The Benefits and Costs of the Clean Air Act from 1990 to 2020. Final Report. Prepared by the USEPA Office of Air and Radiation. February 2011. Table 5-6. http://www.epa.gov/air/sect812/prospective2.html

[3] Bureau of Economic Analysis, National Economic Accounts, "Table 1.1.5. Gross Domestic Product," http://bea.gov/national/pdf/dpga.pdf.

development process. Since that time, the National Research Council (NRC) has made recommendations related to enhancing the development of IRIS assessments. The EPA is making changes to the IRIS Program to implement the NRC recommendations. These changes will help the EPA produce more high quality IRIS assessments each year in a timely and transparent manner to meet the needs of the Agency and the public. A newly released NRC report[4] is largely supportive of the enhanced approach the EPA is taking to develop the IRIS assessment for inorganic arsenic.

As I mentioned in my opening statement, science is the backbone of our decision-making and our work is based on the principles of scientific integrity and transparency that are both expected and deserved by the American people. I am proud of the EPA's research efforts and the sound use of science and technology to fulfill the EPA's mission to protect human health and safeguard the natural environment.

Thank you for the opportunity to testify before you today. I am happy to answer any questions you may have at this time.

[4] http://www.nap.edu/catalog.php?record_id=18594

STRENGTHENING TRANSPARENCY AND ACCOUNTABILITY WITHIN THE ENVIRONMENTAL PROTECTION AGENCY

Thursday, November 14, 2013

House of Representatives,

Committee on Science, Space, and Technology

Washington, D.C.

Committee Hearings

of the

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STRENGTHENING TRANSPARENCY AND ACCOUNTABILITY WITHIN THE ENVIRONMENTAL PROTECTION AGENCY

Thursday, November 14, 2013

House of Representatives,

Committee on Science, Space, and Technology

Washington, D.C.

The Committee met, pursuant to call, at 10:03 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Lamar Smith [Chairman of the Committee] presiding.

Chairman SMITH. The Committee on Science, Space, and Technology will come to order. Welcome everyone to today's hearing entitled Strengthening Transparency and Accountability Within the Environmental Protection Agency. I am going to recognize myself for 5 minutes for an opening statement, and then I will recognize the Ranking Member for hers.

The Environmental Protection Agency, like every other governmental institution, should answer to the American people. Everyone agrees that we need to protect the environment, but we should do so in a way that is open and honest. Democracy requires transparency and accountability.

Yet EPA's justifications for its regulations are cloaked in secret science. It appears the EPA bends the law and stretches the science to justify its own objectives.

Americans impacted by the Agency's regulations have a right to see the data and determine for themselves independently if these regulations are based on sound science or a partisan agenda. The EPA's efforts to expand its regulatory reach across the U.S. represent a troubling trend.

For example, take EPA's current attempt to redefine its jurisdiction under the Clean Water Act. It seeks to expand the definition of Waters of the U.S. to give the Agency

unprecedented new authority over private property.

According to media reports, this expansion of EPA regulatory power could include almost all man-made and natural streams, lakes and ponds in the U.S. This undermines states' rights and increases federal control of private property and could lead to the EPA telling us what to do in our own back yard.

The EPA's efforts to demonize hydraulic fracturing are another example of an Agency implementing a partisan agenda before it takes the time to get the facts. The EPA made wild claims of groundwater contamination but was forced to retract those claims when it could produce no evidence. Perhaps the most worrisome examples of the Agency's disregard for transparency and accountability are found in the EPA's Clean Air Program.

We all agree that ensuring clean air is essential, but the EPA has a responsibility to establish rules that balance our environmental concerns and our economic needs.

Nearly all of this Administration's air quality regulations are justified on the basis of hidden data. These regulations cost billions of dollars but the EPA claims that the benefits of these rules justify the costs. These claims can't be verified if the EPA uses secret science.

More than two years ago, before this Committee, then Assistant Administrator McCarthy said this information was

available for independent review and verification. And a few months ago, the President's own Science Advisor took the same position. When the EPA failed to live up to those commitments, the Committee issued a subpoena requiring the Agency to produce the data. Three months later, the Agency still hasn't provided the data necessary to verify the Agency's claims.

Let me be clear: It is the EPA's responsibility to ensure that the science it uses is transparent and that its claims can be verified independently.

Recently, the EPA provided us with copies of letters it received from scientists explaining why they believe this data cannot be released to the public. It is unfortunate that it took us two years and a subpoena to get here, but now even the EPA knows the truth: The Agency itself cannot publicly verify its own claims.

So not only do we have a lack of transparency, we have an Agency that is regulating without the facts to back up its claims.

We need to know whether the Agency is telling the truth to the American people. The EPA must either make the data public or commit to no longer use secret science to support its regulations. Without this, Congress will have no choice but to prohibit the EPA's use of secret data moving forward.

I will introduce legislation in the next few weeks that will stop the EPA from basing regulations on undisclosed and unverified information.

We can and should continue to look for ways to protect our environment. But these efforts must be open, transparent and based on sound science. Only then can the American people decide whether the costs of EPA's regulatory agenda is supported by the facts.

[The statement of Mr. Smith follows:]

********** INSERT 1 **********

Chairman SMITH. That concludes my opening statement, and the Ranking Member, the gentlewoman from Texas, is recognized for her opening statement.

Ms. JOHNSON. Thank you very much, and good morning. I am very pleased to welcome Administrator McCarthy to today's hearing. She has had a distinguished record at the Environmental Protection Agency prior to her being selected to be EPA Administrator. And by all accounts, she has been doing an exemplary job since assuming the position.

While I think her record of performance and her integrity speaks for themselves, I thought it was important to review the mission of the Agency. First, the mission of EPA is to protect human health and the environment. As someone who worked in public health before I entered politics, I can think of no mission of the Federal Government that is more important or noble than that. As a Member of Congress, I think I should be doing all I can to encourage EPA as it attempts to carry out a very challenging mission. I think too often EPA is made a target for funding cuts and its leadership subjected to harassment and denigration. Unfortunately, our own Committee has not been immune from employing these tactics.

Mr. Chairman, I am a Texan. From birth to death, I am a Texan, and I am no stranger to the oil and gas industries and the economic benefits they can bring or to the pollution and

health and environmental impacts those industries can also bring. I know that EPA's actions have consequences for companies that sometimes are negative. However, I also know that EPA's actions have important consequences for the health of our constituents, especially those who are young, infirmed or elderly. And those consequences have been very positive indeed over the 40 years that EPA has been in existence.

We all want a healthy economy, but we also want a healthy quality of life for our citizenry. And EPA's efforts have played a critical role in achieving both these goals since its inception.

As Members of Congress, I think we should strive to educate our constituents, not scare them. I hope today I can resist the temptation to try for provocative sound bites for my district and instead use today's hearing to better understand what EPA has been tasked to accomplish, how it is doing on those tasks and how we in Congress can help it to do its job more effectively.

Administrator McCarthy, I know you have a very tough job, and I want to commend you for your willingness to take it on in spite of all the hurdles that you and your Agency face. I look forward to your testimony, and I look forward to working with you to help EPA achieve the goals that the Nation has asked us to carry out.

I thank you and yield back my time.

[The statement of Ms. Johnson follows:]

********** INSERT 2 **********

Chairman SMITH. Thank you, Ms. Johnson. Members who have opening statements can submit them for the record, and they will appear at this point.

[The information follows:]

********** COMMITTEE INSERT **********

Chairman SMITH. Our witness today is The Honorable Gina McCarthy, Administrator of the Environmental Protection Agency. Prior to her appointment as Administrator, she was the Assistant Administrator for EPA's Office of Air and Radiation where she advocated to protect public health and the environment. During her career which spans over 30 years, she has worked at both the state and local levels on environmental issues and helped coordinate policies on economic growth, energy, transportation and the environment.

Administrator McCarthy received a bachelor of arts degree in social anthropology from the University of Massachusetts and a master's of science and environmental health, engineering and planning from Tufts University.

At this time I will yield to the gentlewoman from Connecticut, Ms. Esty, for additional comments.

Ms. ESTY. Thank you, Chairman Smith and Ranking Member Johnson for holding today's hearing on the Environmental Protection Agency. I am very pleased to welcome Administrator Gina McCarthy who served as Commissioner of Connecticut's Department of Environmental Protection and then as Assistant Administrator of the U.S. EPA.

Administrator McCarthy, it is wonderful to see you again. Congratulations on your confirmation. You have an important role and responsibility as head of an agency charged with protecting the environment and the public's

health. I appreciate all of your hard work to that end, and we are very proud of you in Connecticut and very pleased to see you here today.

Thank you so much.

Chairman SMITH. Thank you, Ms. Esty. Administrator McCarthy, we welcome your testimony, and please proceed.

STATEMENT OF GINA MCCARTHY, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY

Ms. MCCARTHY. Good morning, Chairman Smith, Ranking Member Johnson, and--oh, I am so sorry. Good morning, Chairman Smith and Ranking Member Johnson, other distinguished members of the Committee. I am pleased to be here to talk about the central role that science plays at the United States Environmental Protection Agency.

Let me begin by stating that science is and always has been the backbone of the EPA's decision-making. The Agency's ability to pursue its mission to protect human health and the environment depends upon the integrity of the science upon which it relies. I firmly believe that environmental policies, decisions, guidance, and regulation that impact the lives of all Americans must be grounded, at the most fundamental level, in sound, high quality, transparent, science.

Because we rely so heavily on science to meet our mission on behalf of the American people, it must be conducted in ways that are transparent, that is free from bias and conflict of interest and of the highest quality, integrity, and credibility. These qualities are important not just within our own organization and the Federal Government, but across the scientific community, with its

long-established and highly honorable commitment to maintaining strict adherence to ethical investigation and research. That is why the agency has established and embraced a Scientific Integrity Policy that builds upon existing Agency and government-wide policies and guidance documents, explicitly outlining EPA's commitment to the highest standards of scientific integrity. And that commitment extends to any scientist or organization who wishes to contribute to our efforts. All EPA-funded research projects, whether they are conducted by EPA scientists or outside grantees or collaborators, must comply with the Agency's rigorous quality assurance requirements.

To ensure we have the best possible science, we are committed to rigorous, independent peer review of the scientific data, the models and analyses that support our decisions. Peer review can take a number of forms, ranging from external reviews by the National Academy of Sciences or the EPA's federal advisory committees to contractor-coordinated reviews.

Consistent with OMB's guidance, we require peer review of all EPA research projects and for all influential scientific information and highly influential scientific assessments.

Among the external advisory committees is the EPA's Science Advisory Board. Our SAB reviews are conducted by

groups of independent non-EPA scientists with the range of expertise required for that particular advisory topic. We invite the public to nominate experts for the SAB panels and to comment on candidates being considered by the EPA for SAB panels. The EPA evaluates public comments and information submitted about SAB nominees. The EPA's review experts' confidential financial information is available to ensure that there are no conflicts of interest.

SAB peer reviews are conducted in public sessions in compliance with the open-government requirements of the Federal Advisory Committee Act. The public is invited to send and to provide oral and written testimony for consideration by the SAB. Public comments help to ensure that all relevant science and technical issues are available to the SAB as it reviews the science that will support our environmental decisions.

Another example of how well we do science and maintain our integrity is the Clean Air Scientific Advisory Committee which provides independent advice to the EPA Administrator on the science that supports EPA's National Ambient Air Quality Standards. The CASAC reviews the EPA's Integrated Science Assessments which deliver science in support of the Clean Air Act.

Through a transparent and open process, we have also committed to enhancing the Agency's Integrated Risk

Information System assessment program. A strong, scientifically rigorous IRIS Program is of critical importance, and the EPA is in the process of enhancing the scientific integrity of assessments, enhancing the productivity of that Program and increasing transparency so that issues are identified and debated early on in the process. In 2009, the EPA made significant enhancements to IRIS by announcing a new 7-step assessment development process. Since that time, the National Research Council has made recommendations related to enhancing the development of the IRIS assessments. The EPA is making changes still to the IRIS program to enhance our ability to respond to those recommendations and to maintain our science integrity. These changes will help the EPA produce more high-quality IRIS assessments each year in a timely and transparent manner to meet the needs of the Agency and the public. A newly released NRC report is largely supportive of the enhanced approach that EPA is now taking to develop the IRIS assessment, in this case, for inorganic arsenic.

As I mentioned in my opening statement, Mr. Chairman, science is the backbone of our decision making, and our work is based on the principles of scientific integrity and transparency that are both expected and deserved by the American people. I am proud of the EPA's research efforts and the sound use of science and technology to fulfill EPA's

important mission to protect public health and safeguard the natural environment.

I want to thank you for the opportunity to meet with the Committee for the first time and to provide testimony, and I am happy to answer any questions that you might have.

[The statement of Ms. McCarthy follows:]

********** INSERT 3 **********

Chairman SMITH. Thank you, Administrator McCarthy. I will recognize myself for some questions.

The first one is this. When you testified before this Committee in September 2011, you promised to provide the data behind EPA's health benefit claims. And yet, to my knowledge, you have not done that. Yet, the Agency continues to justify major regulations based upon these studies. Now, you have given the Committee some information, but do you agree that the information you have given us so far is insufficient to validate these findings?

Ms. MCCARTHY. Mr. Chairman, my understanding is that we have submitted information that you requested.

Chairman SMITH. I don't deny that, but is the information you have given us sufficient to validate the findings that you have come to?

Ms. MCCARTHY. It is sufficient for you to understand the--

Chairman SMITH. I know. I know it is sufficient to understand, but can we validate it independently? Is the information you have given us sufficient to validate independently the findings that you have concluded?

Ms. MCCARTHY. I believe that it is sufficient for you to understand that we have relied on peer-reviewed science.

Chairman SMITH. Well, let me say that we get a letter from the EPA saying that it was not sufficient, so you might

want to check with other individuals within the EPA. We have not gotten sufficient information to validate the findings.

Ms. MCCARTHY. Mr. Chairman, if you are looking to replicate the studies, I would agree with you that all of that information isn't available to the Agency, but we have sought to get that information for you and we have provided that information to you.

Chairman SMITH. Right. The information you have provided--I will just make that statement again--and is validated by a letter we received from the EPA which is not sufficient to validate your findings.

Let me go onto my next question. Next year the EPA is seeking to change its national ozone standards, a move that the Agency admits could be the most expensive regulation in history, I think perhaps exceeding the cost of $100 billion to the American people. Will you specifically commit to not rely on secret science and hidden data in the rule making for the ozone standards? In other words, will you make the underlying data public?

Ms. MCCARTHY. The Clean Air Science Advisory Committee that we rely on as our peer-review entity to take a look at our National Ambient Air Quality Standards ensures that we are public, that we make our information publically available. As far as transparency--

Chairman SMITH. Okay. So the--

Ms. MCCARTHY. --the EPA--

Chairman SMITH. --information will be made publically available that you rely upon to issue the ozone--

Ms. MCCARTHY. In the same way in which we have done it before, Mr. Chairman.

Chairman SMITH. Well--

Ms. MCCARTHY. We are very public--

Chairman SMITH. --the same way--

Ms. MCCARTHY. --with the information.

Chairman SMITH. The same way before wasn't sufficient, so I am kind of wondering if you are saying it will be made public, if it is really going to be made public.

Ms. MCCARTHY. We rely on thousands of studies. We provide an integrated science assessment that is thoroughly looked at for the peer-review process.

Chairman SMITH. Let me take you at your word. You said that the information would be made public, that the data that you rely upon for the issuance of the ozone--

Ms. MCCARTHY. In the same way we have done it always, Mr. Chairman, yes.

Chairman SMITH. Well, okay. We have to disagree on that. I don't think you have always done it, but if you will say you will do it now, I will take you at your word.

Let me ask you this. Have you given the Committee all the subpoenaed data in the EPA's possession?

Ms. MCCARTHY. If you are referring to the PM data that you have requested from the Agency?

Chairman SMITH. No, I am saying--

Ms. MCCARTHY. I am sorry, Mr. Chairman. What--

Chairman SMITH. --have you--

Ms. MCCARTHY. We have a number of subpoenas.

Chairman SMITH. Right.

Ms. MCCARTHY. I just want to make sure--

Chairman SMITH. I am just talking about the one from the Science Committee. Have you given the Committee all the information that we have subpoenaed that is in your possession?

Ms. MCCARTHY. I believe we have as of September 20.

Chairman SMITH. Okay.

Ms. MCCARTHY. Those were related to some specific studies. One was outstanding until September 20 so we could make sure that we had looked at confidentiality and privacy issues.

Chairman SMITH. Okay. Thank you. Will the EPA produce all of its correspondence with outside entities regarding the efforts to comply with the subpoena, and this would include emails, text and other electronic communications?

Ms. MCCARTHY. I believe we are responding to that request today, Mr. Chairman. If you have further questions after that response or you don't believe it is adequate, we

will certainly get staff together--

Chairman SMITH. Okay.

Ms. MCCARTHY. --and we can converse as well.

Chairman SMITH. But otherwise you will say it is going to Freedom of Information Act and give us all that correspondence, is that correct?

Ms. MCCARTHY. We actually respond to a number of Freedom of Information Act requests, Mr. Chairman. If that is your preference, we can do that.

Chairman SMITH. No, don't let me confuse the issue. You are going to give us the correspondence that you have engaged in with the third parties to try to get them to comply with the subpoena?

Ms. MCCARTHY. We are going to respond to your request for that--

Chairman SMITH. Okay.

Ms. MCCARTHY. --I believe today.

Chairman SMITH. Okay. Thank you for that. My last question is this. The EPA has a draft Clean Water Act rule that could give EPA unprecedented authority over private property. The law clearly states that at the time such a proposal is sent to other federal agencies, it must also be made available to EPA's Science Advisory Board, the SAB, for peer review. In September EPA sent its proposal to OMB for interagency review, but according to your SAB, the draft has

not been made available to the Board. Why didn't you comply with this requirement before formally proposing the rule?

Ms. MCCARTHY. Mr. Chairman, I want to assure you that we are going to be and we are complying with our statutory obligations. What you are referring to is a rule that is very, very early in the process of science--

Chairman SMITH. Right, but you submitted it to OMB, and according to the law, when you submit it to OMB, you have got to submit it to your Science Advisory Board, and that hasn't been done yet.

Ms. MCCARTHY. We actually have a process that is established at EPA for how we communicate with the Science Advisory Board on those issues. It is a process that they have agreed to and we have. It is consistent--

Chairman SMITH. The submissions are supposed to be--

Ms. MCCARTHY. --with the law.

Chairman SMITH. The submissions are supposed to be concurrent, and yet you have submitted the rule to OMB but not to the Science Advisory Board. Are you expected to do that immediately?

Ms. MCCARTHY. Again, Mr. Chairman, the Science Advisory Board right now has an opportunity to look at the science that would underpin that rule, but we are very early on in the process and will make sure to comply with the law.

Chairman SMITH. Regardless of where you are in the

process, the law says you have to submit it to the advisory board at the same time you give it to other agencies. But you haven't done that, and I am just wondering why.

Ms. MCCARTHY. Well, it is not a question that we haven't done it. It is a question that we have a process in place--

Chairman SMITH. So you have--

Ms. MCCARTHY. --where we work those issues--

Chairman SMITH. So you have submitted the--

Ms. MCCARTHY. --with the Science Advisory Board.

Chairman SMITH. You have submitted the rule to the advisory board and I am just not aware of it?

Ms. MCCARTHY. As far as I know, I don't believe the advisory board has the rule, but we are very early in the process. Unfortunately, you may have it, and they are likely to have it as well because it has been publically released. But it is in a very early stage.

Chairman SMITH. If there is a law that says you are supposed to submit it to them immediately and you haven't done that and that is not following the proper process--

Ms. MCCARTHY. Mr. Chairman, I am happy to supply you with the articulated process that we use to--

Chairman SMITH. No, I understand--

Ms. MCCARTHY. --comply with that.

Chairman SMITH. The process is--

Ms. MCCARTHY. But we believe we are in compliance with the law.

Chairman SMITH. Yeah, the process is very clear because it is the process required by law that you are not following at this point and I hope you will.

That concludes my question, and the Ranking Member is recognized for hers.

Ms. JOHNSON. Thank you very much. I am a little confused myself. I am seeing stacks, huge stacks of materials that have been submitted, and I don't know what is missing that you have access to that has been requested. Do you understand what is being requested or--

Ms. MCCARTHY. We believe that we do, and we believe that we have complied with those requests to the best of our ability. EPA has provided thousands of pages of material that is been requested of us, and we have done it because we agree with this Committee and its mission to ensure that we have sound science and transparency. That is the commitment of this Agency, and we will fulfill that commitment.

Ms. JOHNSON. Well, thank you. I am really trying to follow the line of question of the Chair to understand exactly what the real problem is. How do you interpret what the questions have been for your understanding and what else do you think that can happen, what can be given?

Ms. MCCARTHY. Well, we have provided the information.

When we do rule making, like National Ambient Air Quality Standards, we look at the thousands of peer-review studies that are available to us. We also fund studies ourselves, and we conduct studies ourselves. When we fund those studies and the information and the data that we gather to fund those, we have to make sure now under the Shelby Amendment that that underlying data is available to us. We have done that. But there is much information that we look at that is peer-reviewed literature, which is really how science works, Ranking Member, is that we rely on rigorous peer-review data. EPA relooks at that to make sure it is been peer reviewed before we rely on it. But we don't have the wealth of data underneath all of the thousands of studies. But clearly researchers, including EPA, can enter into agreements to gather that data, but much of it ends up being confidential or private and we have obligations under other statutes as well as OMB guidance to protect that privacy. In the case of the National Ambient Air Quality Standards, we have the data on air quality, we have the data on deaths. What we don't have available to us with the full breadth of raw data is the cohort data which really follows individuals. So when we have that data, we have to protect it, but we don't need to see the wealth of raw data under every study to know that it has been rigorously peer reviewed and we can rely on it for our decision making.

Ms. JOHNSON. Has there ever been a time when the Congress has requested raw data that--or is this where you need time?

Ms. MCCARTHY. We did actually face similar questionings, frankly, about the exact same issues, the PM studies, the particulate matter studies, from Harvard University and from American Cancer Society. And we were asked similar questions back in the early '90s is my understanding, and we funded through a contractor 30 researchers to look for 3 years at all of that underlying data they had available to it because they could enter into a confidential contract with the researchers to access that data so the private information was protected. They did a complete reanalysis of that data and the methodologies used, and they came out with the same types of conclusions. So we have verified even with that underlying data available that these are studies that can be relied on. These are in fact studies that the world relies on, not just EPA. They are well-done, they are credible and they have not changed their methodology substantially since the last time we even looked at the raw data. So we are very confident in the underlying science and that we have done the right thing and paid attention to that, which is what EPA is supposed to do.

Ms. JOHNSON. Thank you very much. I yield.

Chairman SMITH. Thank you, Ms. Johnson. The gentleman

from Wisconsin, our former Chairman of this Committee, Mr. Sensenbrenner is recognized for his questions.

Mr. SENSENBRENNER. Thank you very much, Mr. Chairman. Ms. McCarthy, on June 27, 2012, you sent a letter to me relative to the issue of ethanol and the waiver on E-15. And I asked the question, does the EPA remain confident that E-15 will not damage car engines from vehicles of model years 2001 and later. The letter you signed responded the EPA remains confident in the technical basis for the E-15 partial waiver decision. This question can be answered simply yes or no. Do you remain confident in the technical basis for the E-15 decision?

Ms. MCCARTHY. I do.

Mr. SENSENBRENNER. Okay. Now here is what others are saying. Ford says Ford doesn't support the introduction of E-15 into the marketplace for the legacy fuel. Ford does not approve. In the owner's manual it is considered misfueling and any damage resulting from misfueling is not covered by the warranty. Mercedes-Benz. Any ethanol blend above E-10 including E-15 will harm emission control systems in Mercedes-Benz engines leading to significant problems. Honda. Vehicle engines were not designed or built to accommodate the higher concentrations of ethanol. There appears to be the potential for engine failure. The AAA. AAA's automotive engineering experts have reviewed the

available research and believe that additional assessment is warranted to more fully document to what extent the sustained use of E-15 in both newer or older vehicles will cause significant problems such as accelerated engine wear, fuel system damage and false check-engine lights. And the Coast Guard. Increasing the blend to E-15 can be expected to exacerbate any fuel system deterioration now being reported with E-10 blend gasoline. Fuel leaks cause an unacceptable risk of fire and explosion. My question to you is are the auto manufacturers, the AAA, the small engine makers and the U.S. Coast Guard wrong and how can the EPA continue to ignore these concerns?

Ms. MCCARTHY. Congressman, I am not going to speak to their issues that particularly the car manufacturers might have relative to their liability and warranty considerations. What I can tell you is that EPA with DoE did extensive testing of E-15 on cars. We understand that there are challenges prior to 2001 which is when some new, more robust engines were required in those vehicles. We have done extensive testing. We continue to believe that E-15 is appropriate, and if it were available it would be being used by individuals for vehicles that are 2001 and younger.

Mr. SENSENBRENNER. Well, that is not what the manufacturers say. That is not what the AAA says. They don't make cars. They represent motorists' interest. That

589 is not even what the Coast Guard said because we are dealing
590 with small engines including marine engines, lawn mowers,
591 snow mobiles and things like that.
592 Ms. MCCARTHY. Congressman, we never--
593 Mr. SENSENBRENNER. Now, ma'am. Ma'am? I am going to
594 ask you a question.
595 Ms. MCCARTHY. I am sorry. Go ahead.
596 Mr. SENSENBRENNER. I am going to ask you a question.
597 Ms. MCCARTHY. Okay.
598 Mr. SENSENBRENNER. Because I have a limited amount of
599 time.
600 Ms. MCCARTHY. All right.
601 Mr. SENSENBRENNER. You will make a very good senator if
602 you would like to filibuster. I have a bill that this
603 Committee has reported favorably out to require the National
604 Academies of Science to conduct an unbiased assessment of the
605 science surrounding E-15. There seem to be enough questions
606 relating to EPA's conclusions on this. So why don't you
607 support further testing of E-15, and why are you opposed to
608 having an unbiased referee making call on this fuel?
609 Ms. MCCARTHY. I don't recall, Congressman, that I have
610 spoken to this issue. EPA--
611 Mr. SENSENBRENNER. Will you support--
612 Ms. MCCARTHY. Again--
613 Mr. SENSENBRENNER. --my bill for more testing on this

issue?

Ms. MCCARTHY. I am sorry. I have not read the bill but if you are asking me--

Mr. SENSENBRENNER. Well, the bill has been around for a long time because it was sponsored in response to your letter where there's a disagreement on whether the EPA has conducted unbiased research. Now, how about having another look at this before people's engines get wrecked?

Ms. MCCARTHY. Additional research that is done credibly and transparent is also--always welcome, Congressman.

Mr. SENSENBRENNER. Fine. I would appreciate a letter from the EPA and from you supporting my bill, and then maybe we can put it on the floor.

Ms. MCCARTHY. But I do feel that we have sufficiently done our analysis, and I continue to rely on it.

Mr. SENSENBRENNER. Well, then I guess having an unbiased view is something that you won't always support.

Ms. MCCARTHY. Well, I--

Mr. SENSENBRENNER. I yield back the balance of my time.

Chairman SMITH. Thank you, Mr. Sensenbrenner. The gentlewoman from Oregon, Ms. Bonamici, is recognized for questions.

Ms. BONAMICI. Thank you very much, Mr. Chairman, and thank you, Administrator McCarthy for appearing before us

today. The work that you do to protect the health of our constituents is very important and very much appreciated.

I want to briefly mention the EPA's work on the Portland Harbor Superfund Site, an issue that is been important for years in the district I represent and in the region but one where I think we could all agree the work has not progressed as expeditiously as it should. And when I met with you in April of this year to discuss the issue, you had yet to be confirmed as administrator, but we still had a very productive conversation and an encouraging conversation about increased cooperation between the EPA headquarters, the Oregon Congressional delegation, and you also expressed an interest in improving the relationship between the EPA Region 10 and our local stakeholders. And so far I have seen positive signs of that happening, and I wanted to say that I look forward to working with you and the EPA to, we hope, finally take care of that superfund site in the Portland Harbor. So thank you for your work on that.

Ms. MCCARTHY. Thank you.

Ms. BONAMICI. On the topic of EPA protecting public health, in your testimony you focus on how important it is that good science be used to determine when public health is in danger. After all, that is one of EPA's critical missions. And in the first hearing held by the Environment Subcommittee--oh, in a hearing held by the Environment

Subcommittee earlier this year, a look at the state of the environment, one witness, Richard Truesbeck, said that looking too closely at a problem can sort of overestimate the need for a solution. He said when one puts anything under a microscope, one necessarily will find something ugly to gawk at.

When considering public health, it is hard to imagine that just because something is small or microscopic, it should not be evaluated to determine its impacts on public health. Surely our constituents can be harmed by pollutants that they cannot see.

So can you talk about the process that EPA goes through to determine when a problem is severe enough to address through federal action, and then I do want to save time for another question.

Ms. MCCARTHY. We address the science in many different ways depending upon what we are actually focusing on and where authorities lie. EPA doesn't agree with a statement that says that we shouldn't be focused on both our mission as well as appropriately doing our job that Congress gave us. We look at both doing independent reviews of the science. We do that rigorously. We do it through something we call the IRIS process which I mentioned earlier, which is really a health assessment that underpins many of the decisions that we do that helps us understand what the science implications

are, what the health implications are for people that are exposed to chemicals and other hazards in the environment. And it is extremely important for us to look at those issues.

Then we look at what authorities Congress has given us, what responsibilities we have and we address those responsibilities in the way in which Congress gave us to address those.

Ms. BONAMICI. Okay.

Ms. MCCARTHY. That is how we make improvements in public health. That is how we have successfully done that for 40-almost 3 years.

Ms. BONAMICI. Thank you. In March of this year the Environment Subcommittee had a hearing on EPA's Science Advisory Board, and since then the committee has passed legislation modifying the makeup of those boards. And throughout the process, some on this Committee have asserted that industry voices are not represented and that academic interests dominate, and others of us acknowledge that the industry perspective should be heard but we are concerned about making sure that we don't have conflicts of interest.

So you discussed this a bit in your opening testimony, but will you please expand on how industry scientists might contribute to the Science Advisory Boards while also avoiding conflicts of interest? And how do you as Administrator ensure that the advice that you are receiving from those

bodies are not tainted with policy-related judgments?

Ms. MCCARTHY. For the Science Advisory Board, we believe the EPA meets and exceeds our responsibilities under FACA, our legal requirements, and we are more transparent and we look more closely so that we can make sure that we look at the Ethics in Government Act as well. The Science Advisory Board in our process for doing that is something that we are very proud of. When we do panels and we put them together, we publish our consideration of who the panel members should be. We ask for comments on that. We respond to that. We look at making sure that the panels we put together are well-balanced and that they have all of the range of expertise we are looking for as well as a variety of perspectives.

Ms. BONAMICI. And can you please discuss the conflict of interest issue because I want to make sure you get that in.

Ms. MCCARTHY. We actually look very closely at conflict of interest which we look at both whether or not there are financial problems that are real or the appearance is there, and we make sure that we do a thorough analysis of both any investment opportunities or financial considerations. We just recently established a new process where we are looking at that as well and more rigorously for external contractors as well.

So we look at the issues, whether they are perceived or real. We do them publically, transparently. We take comments every step of the way to ensure that our panel has the expertise as well as the credibility it needs to speak from a sound science and transparency perspective.

Ms. BONAMICI. Thank you very much. I see my time has expired. Thank you, Mr. Chairman.

Chairman SMITH. Okay. Thank you, Ms. Bonamici. The gentleman from California, Mr. Rohrabacher, the Vice Chairman of this Committee, is recognized for his questions.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman, and following up with my colleague from Oregon's line of questioning. I appreciate her setup, and we appreciate you being here with us today.

Ms. MCCARTHY. Thank you.

Mr. ROHRABACHER. About the Science Advisory Boards--and there is serious concern that the EPA's regulatory science has become somewhat of a closed loop that the Agency sets regulatory goals based on whatever motives those goals are based upon and then develops the funds and the science that it needs to justify those goals. The Agency then creates its own regulations and is solely responsible for interpreting those regulations. Making matters even worse, the courts largely defer to the EPA especially when questions involve the analysis of science.

Therefore, the most critical requirement for America to trust this regulatory policy or system and especially the regulations that are set forth by the EPA is scientific integrity. Unfortunately, as I say, there are worries and we--at least I believe there seems to be some very serious reasons for being worried about this being a closed loop. A closed loop is not going to give us the type of science that we need. We believe that especially this is evident in a matter that you were just discussing with my colleague from Oregon, the independent peer review of EPA science and we believe--and I would like to ask you a few questions about whether or not this has been compromised.

You are responsible for appointing members of the EPA's Scientific Advisory Boards, and let's take a look at Science Advisory Boards such as, number one, the Science Advisory Board and number two, the Clean Air Science Advisory Committee. And you have called these panels independent review boards.

Ms. MCCARTHY. Um-hum.

Mr. ROHRABACHER. And your predecessor described them as being made up totally of independent expert scientists. And that is pretty well what you still agree with? You are--

Ms. MCCARTHY. Um-hum. Yes.

Mr. ROHRABACHER. --still acknowledging that that is still what your goal is and what we are trying to do? I

would like to put into the record some information prepared by the Congressional Research Service that calls into serious question the independence of the experts that sit on these committees.

Chairman SMITH. Without objection, it will be made a part of the record.

[The information follows:]

********** COMMITTEE INSERT **********

Mr. ROHRABACHER. According to the CRS, almost 60 percent of the members of these two panels have received EPA grants since 2000. That is totaling taxpayer-funded grants worth roughly $140 million. Perhaps even worse, a majority of the members of the Clean Air Science Advisory Committee, the panel tasked with critically evaluating the EPA's particulate matter standards that was finalized at the end of 2012, had received--so a majority had received EPA grants directly related to particulate matter since 2010. So you have someone investigating or passing judgment on things that they themselves have been given grants and been involved in the research they are supposedly overseeing. And Ms. Administrator, in the past we have heard EPA witnesses express the point of view that scientists who have received EPA grants are somewhat immune from any potential conflicts associated with these grants that they are involved with or future grants. Do you consider that the recipient of EPA grants, do you consider that if someone has actually been involved and had a grant and done study about something they are supposed to now review that that would compromise that person's ability to have an independent judgment?

Ms. MCCARTHY. No, not in and of itself, as long as we have procedures to ensure that they are fair-minded, that they are there because of their expertise.

Mr. ROHRABACHER. Well, fair-minded just means that they

don't have any bias. We are talking about a built-in bias here. You are trying to say that somebody who has already been given a grant and has reached conclusions is someone that we can then trust to have an unbiased view, after we have paid them in order to have a biased view?

Ms. MCCARTHY. Mr. Chairman, we understand that there have been concerns expressed about that. We also understand that others have expressed concern about having people who are in the industry that we are discussing that would be impacted.

Mr. ROHRABACHER. That is correct. That is a whole--

Ms. MCCARTHY. That is a--

Mr. ROHRABACHER. That is something someone would be concerned about.

Ms. MCCARTHY. But I would say that we use--

Mr. ROHRABACHER. You think government employees are immune from the same sort of bias that you would find in an--

Ms. MCCARTHY. No, I am not saying they are immune, sir. I am saying that we have a process in which we rigorously pursue those issues to ensure that they are there to represent their expertise and that the panel is balanced, that it is fair, it meets all requirements, ethical requirements--

Mr. ROHRABACHER. The question isn't whether they are--

Ms. MCCARTHY. --and technical requirements.

Mr. ROHRABACHER. --isn't balanced. The question is whether there are members who are involved, sometimes at very high levels, and guiding the direction of those panels who actually have a built-in bias in that they have already been granted grants to make a conclusion before you now are asking them for an unbiased conclusion.

Ms. MCCARTHY. We--

Mr. ROHRABACHER. In fact, sometimes, Administrator, they are asked to give assessments of their own work of--in other words, we are now paying someone to give an unbiased assessment of something that is his or her work.

Chairman SMITH. The gentleman's time has expired. The gentleman from Washington, Mr. Kilmer, is recognized for his question.

Mr. KILMER. Thank you, Mr. Chairman. I thank you for coming to take our questions today.

Ms. MCCARTHY. It is good to be here, thank you.

Mr. KILMER. I have got a question regarding EPA funding and prioritization. I represent the 6th District of Washington State which is bordered by the Pacific Ocean and Puget Sound and also includes some of the most pristine natural areas in the country. I want to commend the work of your Agency and all of our federal agencies in the State of Washington for some of the work that is been done to protect our resources. But there is a lot more to be done. Ocean

acidification, storm water runoff, ecosystem restoration are just a few of the issues that we are only beginning to understand, not to mention the effects that these issues have on our marine industries and on the Puget Sound economy.

Faced with this task, myself and Representative Denny Heck along with several of our colleagues created the Puget Sound Recovery Caucus to gather support and try to figure out what we can do on a federal level to solve these direct problems that we are facing in the Puget Sound and also how to be proactive in issues that are just beginning to emerge.

With a limited federal budget and sequestration, receiving funding for these types of vital problems is an uphill battle that we are still climbing and we need to continue to climb, not just because it affects our environment but because it affects jobs and our economy. I realize the issues that we face in the Puget Sound are similar to many other issues across the Nation, and we want to find ways not only to highlight the Puget Sound but we want to make progress, get projects off the ground and fix the problems we need to ensure the vitality of Puget Sound, not just now but in the future.

So first an invitation and then a few questions. One, I would like to invite your partnership with our caucus. I would love to invite you to meet with our members, and would even love to invite you to come out and meet with the folks

who are working on this in our State. And then my question are can you give insights into how we can actually make some progress, particularly in light of this budget environment, how we can fast track and give greater priority to regional efforts like this where the science is clear, the need is clear, and we need to start making some progress.

Ms. MCCARTHY. Well, I do hope that the indiscriminate way that the sequestration has impacted all of the agencies is something that is looked at in the budget, upcoming budget discussions so that everybody can agree on a more sensible and common-sense way to make any reductions that are necessary and to implement the budget effectively.

I do know that we have folks who are working in this area, and you probably know Dennis McLerran. There is nobody in the world that knows or cares more about the issues that you have just identified than he does. I do think there are ways in which we can work together through a variety of shared technical expertise as well as potentially grant funding. We work on those issues together. I have an opportunity over the next three years to make sure we enhance those partnerships. So I would be looking forward to it, and we should have a discussion about how best to do it.

Mr. KILMER. Great. Thank you very much, and I yield back.

Chairman SMITH. Thank you, Mr. Kilmer. The gentleman

from Texas, the Chairman Emeritus of this Committee, Mr. Hall is recognized.

Mr. HALL. I thank you, Mr. Chairman. Ms. McCarthy, I thank you for being here today, and the Committee has worked for several years to ensure sound scientific processes and transparency at the EPA. I think we need a study on the EPA's lack of transparency and accountability some time, and you would be one of the witnesses that we would want you back again.

One of the areas that concerns us is the EPA's very poor track record of science relating to hydraulic fracturing. The EPA is zero for three on that. In Parker County, Texas, Dimock, Pennsylvania, and Pavilion, Wyoming, you and the Agency alleged that hydraulic fracturing had been responsible for--and three times the agency had to back away from these allegations after proper scientific analysis and review exposed these to be totally unfounded.

We have had a number of regulators and scientists testify where you sit today about hydraulic fracturing, and you have sat there and you testified here and you have also testified in the Energy and Commerce Committee. Nearly all of those that have sat before us have confirmed the safety of these unconventional oil and gas techniques. Not one testified that there has been any incidents of groundwater contamination from fracking, not one of them. We have also

received testimony from both the President's Science Advisor as well as the President's Assistant Secretary sitting right where you are under the oath that you have taken for the Department of Energy, said that there has not been a single documented case of groundwater contamination from fracking in this country. You probably won't be surprised that I reference once again in a comment that you made in 2011 that I gave you a chance to take back. I have not seen where you have made any apology for it when you said--and I hope you have backed off of this remark since then. You said I certainly don't want to give the impression that the EPA is in the business to create jobs. A cruel statement I think to those families that can't support their children, can't make a car payment, because according to a 2012 study by the research company IHS Global Insight--by Investor's Business Daily hydraulic fracturing--estimated 1.7 million jobs in the United States. That number is projected to go over 3.5 million jobs by 2035. And according to the Energy Information Administration, natural gas production is expected to rise an estimated 44 percent through 2040. Without the use of hydraulic fracturing technology, the Nation's energy security and economy would seriously be compromised. Those millions of jobs would be lost.

With that in mind, you stated recently in the interview with The Globe, Boston Globe, I quote, ''There's nothing

inherently dangerous in fracking that sound engineering practices can't accomplish.''

So do you agree that hydraulic fracturing is safe and that there has not been a single documented case of groundwater contamination from fracking? Yes or no.

Ms. MCCARTHY. I can't answer it that way. I will agree with you--

Mr. HALL. Well, then yes, you have answered it. If you can't answer it that way, you don't know or you refuse to answer it.

Ms. MCCARTHY. No, I meant I would like to explain it a little bit if I could.

Mr. HALL. I am not asking for your explanation. I just asked you for a yes or no.

Ms. MCCARTHY. I do not know of a documented case--

Mr. HALL. I will go on.

Ms. MCCARTHY. --of groundwater contamination.

Mr. HALL. I will take that as you don't know or you don't care because you didn't know and you didn't care about people having jobs back then. That was a terrible statement that you made, and it is of--

Ms. MCCARTHY. Actually, it was taken out of context.

Mr. HALL. --record. It was not taken out of direct context. I read it exactly out of the CR, and you know that. Now why don't you admit it?

Ms. MCCARTHY. Well, it was actually celebrating the fact that we have been successful in reducing environmental pollution while we have grown jobs.

Mr. HALL. Let me go on. So you agree that this hydraulic fracturing is safe. Do you agree to that?

Ms. MCCARTHY. I cannot agree.

Mr. HALL. Okay. You haven't agreed. These experts that have testified before you have also agreed that state regulators have the expertise, competence and experience necessary to oversee hydraulic fracturing. Do you agree that the state regulators are generally quite knowledgeable about local geologic conditions in the drilling operations they oversee? Yes or no.

Ms. MCCARTHY. I believe they are knowledgeable and they often seek EPA's technical advice.

Mr. HALL. I think your answer is led to be yes. Do you think the EPA is better suited to regulate hydraulic fracturing operations than the state regulators who are already doing so? Yes or no.

Ms. MCCARTHY. I believe that with water quality, the state is the line of first defense and EPA is with the state in those--

Mr. HALL. I am not asking you to filibuster anymore. Yes or no.

Ms. MCCARTHY. I am trying to understand how to--in the

context of the authority we are given.

Mr. HALL. You are not making me understand. Maybe I can't understand anything you say because--

Ms. MCCARTHY. Okay.

Mr. HALL. --you are hard to believe, ma'am. Do you believe that natural gas prices will remain low if EPA promulgates regulations that restrict production? Yes or no.

Ms. MCCARTHY. I actually think that a large component of the Nation's energy security relies on the safe and responsible development of oil and natural gas, sir.

Mr. HALL. A Nation depends on an all-of-the-above energy strategy, and the use of technologies like hydraulic fracturing have been an important role in helping achieve energy security. We need you to support it, not deter it and not deter these efforts.

Ms. MCCARTHY. And I would hope not, sir.

Mr. HALL. I yield back my time, Mr. Chairman.

Chairman SMITH. Thank you, Mr. Hall. The gentlewoman from Connecticut, Ms. Esty, is recognized for her questions.

Ms. ESTY. Thank you, Mr. Chairman, and thank you, Administrator, again. Connecticut, as you know exceptionally well, has been the beneficiary of substantial improvements to health through the Clean Air Act, and so I would like you to talk a little bit about the situation now. Many utilities have already installed pollution control devices on their

facilities. If EPA at this time were to pull back on clean air regulations governing these utilities, would they have and do you believe they would have an incentive to run these pollution control devices and what would be the associated impact on air quality and public health, particularly for those of us, I would have to say, on the Eastern Seaboard who with west-to-east winds are the recipient of what is burned in Indiana, Ohio and elsewhere?

Ms. MCCARTHY. Well, we know even with the control equipment working that the power sector remains the largest single stationary source sector in terms of the amount of pollution that it emits. We have been working hard with them, but there is no question that there is financial incentive to bypass equipment when it is available to be done.

So I would assume that if we were to pull back on our regulations, what you are going to see is increased emission. And that increased emission results directly in public health impacts that are as severe as thousands of premature deaths.

Ms. ESTY. I know in our own State, we have seen those asthma rates rise very substantially in our cities, and those are costs that are borne primarily by state governments who then have to pick up the tab and by insurance companies to--

Ms. MCCARTHY. And many because of pollution, that comes

to you from facilities run very far away.

Ms. ESTY. Exactly. If we could turn for a moment to the scientific review process, certainly we have heard some commentary today and elsewhere from Members of Congress who have stated that or suggested that EPA develops regulations based on faulty scientific evidence. Can you explain to us in a little more detail--and then I will ask my question and then listen--how the scientific process that underpins EPA regulations is peer reviewed, what you believe to be the importance of peer-review process, and flesh that out a little bit more for us, please.

Ms. MCCARTHY. Yeah. The process that we use is to actually establish peer-review panels. We can do them by seeking advice from the National Academies of Sciences. We can establish it through our Science Advisory Board, and we can use consultants that follow similar processes and establish again transparent, robust, balanced peer review.

The Science Advisory Board is a highly transparent, professional entity. We are--as a FACA, we comply with those regulations. We also comply with ethics requirements. We follow all of the guidance that is given to us in the directives by the Office of Management and Budget in how to do our work. I believe that we are a model for transparent, solid, high-quality science.

And the Clean Air Act Science Advisory Committee was

mentioned. That advisory committee was just recently looked at by our own IG, our Office of Inspector General, who just issued a report commending us for how solid our panel was in our ability to have that balanced and appropriate. Now we are always working to enhance that, but I am incredibly proud of the science this Agency relies on, and I know the high quality of our science is what is going to keep EPA relevant and make us and allow us to do the right thing in terms of meeting our mission which is public health protection.

Ms. ESTY. And if I may--I am shuttling between hearings, and currently in the Transportation and Infrastructure hearing, we are talking about the cost of Sandy and the underwater rail lines in the State of Connecticut and Newark, New Jersey, the impacts of the severe weather systems that we see. Can you talk a little bit about how EPA--other than the curbing of greenhouse gas emissions, what other work is EPA doing to look at the scientific but also the very real economic impacts, I have to say, on the Eastern Seaboard we are seeing from climate change and severe weather conditions?

Ms. MCCARTHY. Congresswoman, in 2012 the costs associated with disaster response topped $120 billion. That is not planned expenses. That is what happens. And what we know is that in the face of a changing climate, these types of disasters are going to become more and more prevalent if

we don't reduce greenhouse gases.

If you look at the work of this Agency, we have not only been funding efforts at the local level and the state level to look at how you can adapt to a changing climate, we have put out a plan that requires and shows a pathway forward, for EPA to look at how it does its business working with the communities. So we look at a changing climate, and we factor that into our decision making, in our ability to work more carefully and collaboratively with local communities and states moving forward. And my heart goes out to Connecticut. I know it was very hard hit, and it is my home away from home.

Ms. ESTY. Thank you for your service, and I yield back.

Chairman SMITH. Thank you, Ms. Esty. The gentleman from Texas, Mr. Neugebauer, is recognized for his questions.

Mr. NEUGEBAUER. Well, thank you, Mr. Chairman. Administer McCarthy, thank you for appearing before this hearing today.

Ms. MCCARTHY. Thanks for inviting me.

Mr. NEUGEBAUER. I have several questions, and so if you could keep your answers pretty short and direct. First, as you know, setting the levels for the new source performance standards, the Clean Air Act requires you to select the best system of emission reductions for technology that has been

adequately demonstrated.

Ms. MCCARTHY. Um-hum.

Mr. NEUGEBAUER. Now, we have had several hearings in this Committee on the new standards where we have heard testimony whether the CCS technology necessary to meet these standards has actually been adequately demonstrated at the full-scale power plants.

I have asked your colleagues from the Department of Energy on a number of occasions if they could give me examples of where full-scale power plants are located, and their testimony is none of them are operating anywhere in the world. If this is true that full-scale power plants operating now are not operating with CCS technology, how can you say that it has been adequately demonstrated?

Ms. MCCARTHY. We believe, sir, that CCS technology has been adequately demonstrated. The technology is proven, it is available. In fact, the coal technologies in facilities that you see being constructed today are actually utilizing CCS.

Mr. NEUGEBAUER. So can you give me, provide me an example of a full-scale power plant that is currently operating with this technology?

Ms. MCCARTHY. I can give you examples of two that are 75 percent completed, and I can give you an example of others that are coming up that are also in the planning stages. So

CCS for coal--

Mr. NEUGEBAUER. So what would those be?

Ms. MCCARTHY. --is actually what is being invested in.

Mr. NEUGEBAUER. What would those be?

Ms. MCCARTHY. We have the Kemper facility that is 75 percent complete, and there is another project in Canada that is also utilizing it at levels much higher than the types of reductions that EPA has proposed in its new source data.

Mr. NEUGEBAUER. Are any of those facilities that you mentioned receiving ENSPS funding--clean coal power initiative funding, excuse me?

Ms. MCCARTHY. It is my understanding that there has been funding supported by DoE. DoE continues to have funding available for these types of projects.

Mr. NEUGEBAUER. So they are receiving clean coal power initiative funding?

Ms. MCCARTHY. Yes, that is my understanding.

Mr. NEUGEBAUER. Well, it is kind of interesting then because the Energy Policy Act of 2005 clearly states that projects receiving funding from this program can't be used to prove technology is adequately demonstrated. So the examples that you are using are receiving funding, and the 2005 act says that you can't use those. So can you explain your logic on that?

Ms. MCCARTHY. Actually, sir, I think we are regulating

and proposing this regulation under the Clean Air Act which is very specific in both its intent as well as its history of application. There is no question that CCS technology is available. The components of CCS have been in place and demonstrated for decades. So the question really is, is it reasonable in cost and is it available for this sector? EPA believes it is, but we have proposed that. We are welcome and open to comments. We will be getting to that public comment process shortly. But I think through that public comment process you will see that this technology is well-known, it is available, it is being invested in today and it is going to work and it is going to be a pathway forward for coal into the future.

Mr. NEUGEBAUER. No, but I think what--to summarize what you have said is, one, there is no full-scale power plants operating with this technology today. Is that correct?

Ms. MCCARTHY. I am aware of--these components being operated in many different applications.

Mr. NEUGEBAUER. I didn't say components, but there is no full-scale power plant operating with these--

Ms. MCCARTHY. No, but the ones being invested in would be operating--

Mr. NEUGEBAUER. No, that is right. Okay.

Ms. MCCARTHY. --at much higher levels than we would be requiring.

Mr. NEUGEBAUER. So and then you are using federally funded CCS projects to argue technology is adequately demonstrated, yet the 2005 act prohibits you from doing that.

Ms. MCCARTHY. Actually, we think it has been adequately demonstrated, but the support--

Mr. NEUGEBAUER. But not on a full-scale basis, right?

Ms. MCCARTHY. --from DoE will help advance the technology.

Mr. NEUGEBAUER. Not on a full-scale basis? We don't have that yet.

Ms. MCCARTHY. We have it on full scale in other applications, sir, other industry sectors.

Mr. NEUGEBAUER. But not on these--

Ms. MCCARTHY. It is only--it is being invested in today and in two facilities are 75 percent complete and on their way.

Mr. NEUGEBAUER. But what you are saying under these new rules is no new coal plants can be built without utilizing this technology, and we don't know that it is adequately demonstrated for these plants because we don't have a full-scale model.

Ms. MCCARTHY. We believe it has been adequately demonstrated.

Mr. NEUGEBAUER. But not on a full-scale model.

Ms. MCCARTHY. It has been fully utilized in other

industry sectors.

Mr. NEUGEBAUER. But not on these coal plants, not on a full-scale coal plant.

Ms. MCCARTHY. I have already indicated to you. We know of two that are being constructed today, and they are--

Mr. NEUGEBAUER. That they are being constructed, but we don't have any history that that technology is, one, will accomplish that, but secondly, that it meets any kind of cost-benefit analysis, do we?

Ms. MCCARTHY. The cost-benefit analysis? Is that what we are talking about, sir?

Mr. NEUGEBAUER. No, I mean--but that would be a part of that. I mean, you don't know for sure because you don't have a model where this technology is--

Ms. MCCARTHY. No, but we do know that the industry sees CCS technology as a pathway forward. We also see it as one that is available to it and ones that we are hoping with DoE assistance it will continue to progress. It will get less and less expensive. That is how technology gets developed. But in this case, all of the components of CCS as well as those together have been demonstrated over and over as being viable and effective, and we believe that they will be the path forward for coal. Coal is a big part of our energy supply. I know it is going to continue to be a big part of our energy supply. We have tried very hard to make sure that

we look at the technologies available to it today so it continues to have a path forward.

Mr. NEUGEBAUER. But we don't tend to use research funds for things that have already been determined adequately demonstrated, do we? And so we are using research funds to try to prove this up, and you are using it as an example that it is adequately demonstrated. I just--it doesn't make sense to me.

Ms. MCCARTHY. Actually, we are coordinating very closely with DoE, and if you have listened and heard from the DoE folks today, you will know that they share our opinion about its availability and that it is been demonstrated. But it is exciting to think that we could make it more cost-effective moving forward and that you could expand the range of sequestration opportunities. So they are actually working very hard with the industry to continue to move that technology forward. That is only good news, sir. That is not bad news.

Chairman SMITH. The gentleman's--

Mr. NEUGEBAUER. But we still don't know whether it is adequately demonstrated.

Chairman SMITH. The gentleman's time has expired. Thank you, Mr. Neugebauer.

Pursuant to the discussion earlier about the sufficiency of the data provided by EPA relating to the Committee's

subpoena, I ask unanimous consent to enter into the record a letter from the Texas Commission on Environmental Quality the Committee received just last week that makes clear, ''that the data provided to date lacks critical information, making it impossible to replicate the findings'' of the EPA. Without objection, that will be made a part of the record.

[The information follows:]

********** COMMITTEE INSERT **********

Chairman SMITH. We will go now to the gentlewoman from Maryland, Ms. Edwards, for her questions.

Ms. EDWARDS. Thank you, Mr. Chairman, and thank you Madam Administrator. I really appreciate your being here, and I certainly appreciate your patience.

We have heard described on this Committee and throughout the Congress frankly questions about EPA's reliance on faulty and secret science, questions about EPA's transparency and accountability. First of all, I want to thank you for the transparency and accountability the EPA has provided for the volumes of data and correspondence that this Committee has received. And I am just curious that sometimes the correspondence asks for information, sometimes for documents or data as evidenced by testimony, by questions here today. I am a strong supporter of Congressional authority, but I really am concerned about whether we may be overstepping our authority in terms of what we are requiring of the Agency. We are just one committee of many who's making these types of requests to the EPA. And so I wonder if you could just tell me how much time and energy is spent by you and your colleagues at the EPA in responding to these volumes of requests?

Ms. MCCARTHY. Congresswoman, we know how important it is to be transparent, and we will do our very best to respond to any request that Congress brings to us. It is a

significant burden in terms of resources. But that is just the amount. I don't mean burden in the negative sense. We want to be open. We want to be responsive. But we receive thousands of these types of requests. We do our best to answer them as expeditiously as we can. I think the times when we have had difficulties is when we have been asked to release data that the EPA doesn't have available to it. Then it becomes an extra effort for us to try to make sure we bridge those gaps with scientists when we fully expect that researchers themselves will access that data as they have always done and work it out that way.

Ms. EDWARDS. Well, let me just ask you this because we have heard some discussion of conflicts of interest. I can understand, and we have heard testimony in this Committee, that when you are forming--when there's peer review done and you are delving into some area of expertise that is a very narrow area, there are only so many folks out there who have the kind of experience that you can draw upon. Some of those may be in industry, some of those may be academics who receive grants. When you assess conflict of interest and, you know, I am just like a cheap lawyer. And so I always thought that the idea behind conflicts is revealing those conflicts, having them assessed and then making a determination about whether that conflict would prohibit performance, adequate performance, and independence of

performance in a peer-review situation. Is that how the EPA looks at conflict of interest?

Ms. MCCARTHY. That is exactly how we do that. You are right. There are opportunities or instances where we have a very narrow expertise that is not represented that is critical to a thorough look at a science question or a technical question. In that case we do a thorough investigation. We post the results of that so that people can know the background and we can make sure that it is a balanced, fair, equitable discussion and as transparent as we possibly can be. And so we do that both for folks who are the scientists as well as folks that bring their history in the industry to the table.

Ms. EDWARDS. And is there anything necessarily exclusionary whether a person receives billions of dollars or a company in profits from an industry or whether a person receives thousands of dollars from the Administration in terms of doing research? Is there anything exclusionary about that that would prohibit service on a scientific advisory panel?

Ms. MCCARTHY. I don't believe so. What it really means is we must have a rigorous and transparent peer-review process and we must rigorously share that information with the public so they can--before the panel is empanelled, they can offer their suggestions and comments and criticisms, and

we can make sure that we have the most robust fair, comprehensive science available to us.

Ms. EDWARDS. Thank you. I want to ask you about your work around climate change because there has been a lot of discussion also. Is it your view from the Administration that you have sufficient data to back the work that you are doing around climate change, that in fact it is happening and that there are certain causal effects that would enable you to do rule-making in that area?

Ms. MCCARTHY. I believe that I have a wealth of data that is more than sufficient. I believe that the Supreme Court has agreed with me, which is nice.

Ms. EDWARDS. Great. And so can you tell me about some of the rule-making that you are engaged in going in that direction and then relate that to the mission of EPA protecting our public health and the environment?

Ms. MCCARTHY. Yes, the President's Climate Action Plan identifies mitigation opportunities and reductions in greenhouse gases as well as addressing adaptation and then international issues. EPA is to some extent involved in all three. But I think the most important I want to get at is our opportunity to reduce greenhouse gases so we can try to mitigate significant impacts associated with increased emissions in higher levels of climate change.

And so what we are really looking at is first and

foremost regulating greenhouse gas emissions from the power sector, both the new facilities and existing. We have already issued a proposed rule for new facilities, and we are beginning listening sessions and discussions on how we best put out a proposal next June for existing facilities. The reason why we want to do this is that climate change is not an environmental problem. It is a serious public health and economic problem as well as an environmental challenge. And so what happens with a changing climate is that the weather gets hotter. When the weather gets hotter, the ozone levels increase. When the ozone levels increase, your kids go to the hospital more often with asthma. In this country today, one out of ten children have chronic asthma. We are talking about serious public health challenges. Allergy seasons extend. We are seeing health impacts from different types of mosquitoes and other vector-borne diseases moving north as the weather gets warmer. Things are changing, and things are not changing for the best in terms of public health in a changing climate. It threatens the health, safety and well-being of communities and individuals. It is something we must address and now.

Ms. EDWARDS. Thank you very much for your testimony, and thank you so much for the work that you do to protect all of us.

Ms. MCCARTHY. Thank you.

Chairman SMITH. Thank you, Ms. Edwards. The gentleman from Illinois, Mr. Hultgren, is recognized for his questions.

Mr. HULTGREN. Thank you, Mr. Chairman. Thank you, Administrator McCarthy for coming and testifying today. I do honestly believe that what you are doing is important. That being said, I have a number of problems with how EPA has done its job. Putting forward rules without adequate stakeholder input or a full grasp of the negative impacts proposed rules will have on regular Americans. I think it is important to point out how far we have come, even according to your own data. Since the implementation of the Clean Air Act, aggregate emissions have dropped by 72 percent, all while energy consumption has increased by 47 percent. Vehicle miles traveled has increased by 165 percent, and most importantly, GDP has increased by 219 percent.

That is why I will continue pushing your Agency to base regulations on sound scientific principles and practices, make your data sets open to the public for review and to utilize common-place statistical measures and methods, all of which EPA has seemed adverse to when the facts don't necessitate what often appears to be a politically predetermined regulatory approach.

As you know, Section 316(b) of the Clean Water Act requires the best technology available to minimize harm to aquatic organisms living in water that are withdrawn through

cooling water intake structures for power plants. For the last three-and-a-half decades, states and permitting authorities have been setting necessary controls on a site-specific basis. But unfortunately, it now appears that the EPA is again attempting to rewrite the rules to expand your regulatory power. When relying on the science, EPA has not been able to justify this rule-making. This is because the costs always outweigh the benefits. Your agency has recognized that there will be no benefit to human health, and the economic benefits from potential improvements to commercial fisheries and recreation bodies, the use benefits, will not justify the new rules cost, either.

Since the Agency has been unable to justify these rules with their standard methods, I am troubled with the idea of non-use benefits that you are now attempting to put in place. Even more troubling is the way EPA intends to assign values to these benefits--polling. I think every member in this room can attest to the inaccuracies of polling, and it is troubling to me that the EPA would turn away from science and to a public opinion poll to promulgate regulations. When EPA did their survey asking how much money the public was willing to spend to save a given number of fish, the numbers predictably came back inflated. Then EPA punted the issue to the Science Advisory Board.

Also troubling with the rule is that it could be

interpreted to force power plant owners to monetize these non-use benefits and perform willingness to pay surveys for specific control technologies on a site-specific basis.

Although 316(b) is the EPA's first attempt to justify rule-making with this willingness to pay surveys, I am also worried that this controversial methodology will only encroach into other rule-making. If this happens, public opinion polling will become the backbone of many EPA regulations instead of science.

I think it is important that states are allowed to continue exercising permitting discretion. I am asking could you confirm that the EPA's final 316(b) rule will not require states to consider non-use benefits or require plant owners to conduct willingness to pay surveys in the NPDES permitting process?

Ms. MCCARTHY. The final 316(b) is at the Office of Management and Budget, so I am constrained about getting into too much detail. But we have heard similar comments during the public process. The survey that we did was appropriate on the national level to get a handle on people's willingness to pay for the types of improvements that these technologies would bring. We don't expect that to be the way in which states and permittees make case-by-case decisions.

Mr. HULTGREN. Well, again, I think the most important thing is to base this on science, not on public opinion

polls.

Ms. MCCARTHY. I understand.

Mr. HULTGREN. You can ask all of us how we feel about public opinion polls and the accuracy of them. Certainly for us to be basing--

Ms. MCCARTHY. I understand.

Mr. HULTGREN. --the scientific decisions and significant costs on them is very troubling. I have another quick question that I hope to get an answer. It is regarding when EPA plans on publishing rules, adjusting the volume requirements for the renewable fuel standard. As you know, with the predictions that were made when designing the RFS not being realized, those predictions have not been realized, your Agency is who are farmers and everyone else downstream must get answers from regarding the early adjustment for this requirement. I think everyone was pleased that the first two adjustments came in a timely manner which helped to bring certainty for all parties involved. The final rule for the 2011 adjustment was published in the beginning of December in 2010, and the 2012 rule came in January of that year.

What is troubling is how long it took EPA to issue their final rule for 2013. It didn't happen until the middle of August. As it is important that our businesses and farmers be able to plan ahead for this, can you give this Committee assurance that you will focus on getting a final rule out in

a reasonable amount of time this year and wonder if you could give a perspective date or timeframe when you expect to have this rule published?

Ms. MCCARTHY. The rule to establish limits for 2014 is soon to be proposed. It will take some time. We did tee this issue up in our 2013 proposal. The only thing I want to make sure that the Committee is aware of is the levels that we are talking about for renewable fuels to get into the system in 2014 are not predictions. They are Congressional mandates that we are dealing with in trying to understand the authority that Congress gave us to--

Mr. HULTGREN. Well, my time is winding down, and I want to be respectful of the 5 minutes.

Ms. MCCARTHY. I apologize. Me, too.

Mr. HULTGREN. So anyhow, the issue is bringing certainty to our businesses and farmers.

Ms. MCCARTHY. I agree with you.

Mr. HULTGREN. The sooner we can get these--

Ms. MCCARTHY. I agree with you.

Mr. HULTGREN. --again, earlier over the last few years, this did happen quickly. I would just ask you for my farmers, for my businesses, to have it as quickly as possible--

Ms. MCCARTHY. I agree with you.

Mr. HULTGREN. --to bring certainty back.

Ms. MCCARTHY. I agree.

Mr. HULTGREN. With that, I yield back, Mr. Chairman. Thank you.

Ms. MCCARTHY. Thank you.

Chairman SMITH. Okay. Thank you, Mr. Hultgren. The gentleman from California, Mr. Takano, is recognized for his questions.

Mr. TAKANO. Thank you, Administrator McCarthy, for your testimony today and your appearance before this Committee.

I have to tell you, it is frustrating to me to sit here and listen to my colleagues on the other side of the aisle beating up on the EPA. My colleagues and I have seen first-hand how the EPA--not my colleagues, my constituents and I have seen first-hand how the EPA and the Clean Air Act have improved air quality and advanced public health in my district. Nationally, the stories are just as compelling. A study by the EPA shows that by 2020 the benefits of the Clean Air Act will outweigh the costs by more than 30 to 1. The Clean Air Act has helped improve public health by cutting down cases of asthma, heart disease and infant mortality, and by 2020, it is expected to prevent 17 million lost work days because people are healthier.

I believe the EPA is a driver of innovation, pushing the industry to adopt new standards that protect the environment, improve public health and create jobs in emerging fields.

Administrator McCarthy, could you go into more detail about how the EPA rules have actually created jobs in our country and what new structures have grown because of EPA action?

Ms. MCCARTHY. Actually, thank you for asking that. It helps me to put the job code in a little bit more perspective. I think you would see as we have done a considerable amount of analysis as we do with every rule, about every significant rule looking at job implications, we have been able to make these considerable pollution reductions at the same time as we have been able to continue to grow the economy here in the U.S.

We are looking at actually a pollution control technology industry that now tops around $2 billion annually. We are leaders internationally in those issues. It is because we have been moving at a concerted pace to get better and better at how we reduce pollution, and we are doing it in a way that is affordable and that is extremely beneficial to the public health. We are talking about saving millions of lives. We are talking about really improving the health of our most vulnerable populations, our children and our elderly. I mean, we are talking about growing jobs, not taking them away, and we can provide you with significant more detail, Congressman. But I appreciate your asking the question because EPA is about public health. But we do it always conscious of how we can reduce economic impacts and

actually build the economy at the same time.

Mr. TAKANO. Madam Administrator, I just wanted to clarify something. My colleague, Mr. Rohrabacher, cited a CRS report which indicated an inherent conflict of interest found among members, academic members of its advisory committees. However, this report, which I have right here, made no such conclusion. Rather, it noted that these grants are actually to academic institutions--

Ms. MCCARTHY. Yeah.

Mr. TAKANO. --where the member is employed. And not the member and only a very small proportion of any of the grant may be paid in the form of salary to a member. Is that your understanding as well?

Ms. MCCARTHY. Yes, it is. Yes, it is. Thank you, Congressman, for raising that.

Mr. TAKANO. Yes. With the conclusion, Mr. Chairman, with the discussion of the Committee's subpoena regarding the Harvard and American Cancer Society studies, I would like to enter into the record letters that the Chairman received on October 30 from Harvard, Brigham-Young University, the ACS and the American Cancer Society and the Health Effects Institute. These letters highlight the serious legal, ethical and policy concerns regarding the release of individual health information.

Chairman SMITH. Okay. Without objection, those letters

will be made part of the record.

[The information follows:]

********** COMMITTEE INSERT **********

Chairman SMITH. But just for clarification, those letters were actually addressed to the EPA, not to me.

Mr. TAKANO. Okay. Thank you, Mr. Chairman. Madam Administrator, if I understand these science advisory committees, the industry is--in your opinion, is the industry adequately represented on these committees for a full balance of use?

Ms. MCCARTHY. The members on these panels don't represent specific sectors. They do represent expertise and knowledge and experience. And from my experience in working with these panels is that folks who have worked in the industry usually provide a perspective that is necessary on these panels. So it is a broad and balanced panel when we pull them together. That is required under law, and we even go above and beyond to ensure that that is the case.

Mr. TAKANO. So in your view there was no such closed loop, that these are open-minded panels that are not contained by a particular ideology?

Ms. MCCARTHY. That is exactly what we are required to do under the law, and I think we do a very good job at ensuring that it is not at all closed. It is very open. We just look for good expertise so we can get the best science.

Mr. TAKANO. Thank you, Mr. Chairman. My time has expired.

Chairman SMITH. Thank you, Mr. Takano. The gentleman

from Georgia, Mr. Broun, is recognized for his questions.

Mr. BROUN. Thank you, Mr. Chairman. Administrator McCarthy, I have a very limited amount of time and very many questions, so please answer as quickly as you possibly can so we can get through.

I am a physician, and I want to make sure that we are on the same page about basic principles of toxicology, one of which is if the dose makes the poison. A good example is two aspirins will help relieve the headache, 50 aspirins is a toxic dose. Would you agree with that premise that the dose makes the poison? Yes or no.

Ms. MCCARTHY. I don't want to speak to the science--

Mr. BROUN. Yes or no, please.

Ms. MCCARTHY. --but the dose is very important to us, yes.

Mr. BROUN. So the answer is yes. Even though fine particulate emissions have dropped 55 percent over the last two decades, it is noted on your all's own website, EPA's own website for air quality trends, your Agency has been very concerned with the health effects associated with fairly low dosage, low levels of particulate matter, or PM. It has been the basis of most of your recent Clean Air Act regulations. Agency analysis suggests that hundreds of thousands of Americans die from PM exposure every year. According to your website, ''Numerous scientific studies have linked

particulate particle pollution exposure to premature death, cancer, non-fatal heart attacks and aggravated asthma.'' Does the science suggest that PM can cause cancer?

Ms. MCCARTHY. I do not know. I cannot answer that question, sir. I am sorry.

Mr. BROUN. Okay. Well--

Ms. MCCARTHY. I don't know what the word suggests is, and I don't know how the scientists would interpret that. I wait until they tell me.

Mr. BROUN. Well, okay. EPA's most recent assessment of PM stated that there was ''strong epidemiological evidence linking short-term exposure to PM as measured in hours, cardiovascular and respiratory mortality and morbidity.'' Is that still true?

Ms. MCCARTHY. I believe so.

Mr. BROUN. Okay. If the dose makes the poison, as you just indicated you believe that they do and I do, too, and you think that hundreds of thousands of people die from fine particulate levels at the lowest level, why has your Agency conducted a series of human tests in North Carolina that exposes unknowing volunteers, that have no knowledge of the exposure, including those with pre-existing respiratory issues and asthma, to particulate concentrations as high as 750 micrograms? That is more than 60 times the standard. Would you explain, please?

Ms. MCCARTHY. To my knowledge, we have not done that.

Mr. BROUN. Yes, ma'am, you have. And, in fact, the Inspector General has been investigating this, and we found out about this through the Freedom of Information Act. Were these individuals informed that they were being subjected to a pollutant that EPA thinks causes mortality and cancer, especially since many came from susceptible populations?

Ms. MCCARTHY. It is my understanding that the human studies work that we are doing was recommended by the national academies. It is done with the highest ethical standards. We medically--

Mr. BROUN. Ma'am, I--

Ms. MCCARTHY. --treat every--

Mr. BROUN. --disagree, because these people--according to the knowledge that we have gotten is they were unknowing that they were being exposed to these high levels of exposure of particulate matter. And, as far as I am concerned, as a physician, as a scientist, this is totally unethical, and totally unacceptable. Let me ask you one more question, because my time is running out. Are you signed up for Obamacare?

Ms. MCCARTHY. No, I am not.

Mr. BROUN. Why not?

Ms. MCCARTHY. Well, because I am lucky enough, as a Federal Government, that I have health care available to me,

which I have signed up for. In a few years, when that is not the case, I will be happy to have other available--

Mr. BROUN. Well, our President says that--

Ms. MCCARTHY. --health care--

Mr. BROUN. --Obamacare--

Ms. MCCARTHY. --opportunities--

Mr. BROUN. --is much better than forcing most federal employees to--into Obamacare. And, obviously, if you are not signing up, you don't think it is. Mr. Chairman, I have run out of time. I yield back.

Chairman SMITH. Thank you, Mr. Broun. The gentleman from Massachusetts, Mr. Kennedy, is recognized for questions. We have had some problems with the audio system. How about that one? There we go. Okay, there we go.

Mr. KENNEDY. Thank you. Thank you, Mr. Chairman. Thank you, Madam Administrator, for being here, and I apologize for the raspy voice. It has been going around a bit, so, apologies. I just wanted to start off by saying welcome, and thank you. It is always nice to see another member of Red Sox Nation here today, so--and certainly in front of our committee.

Ms. MCCARTHY. Go Sox.

Mr. KENNEDY. There you go. I want to thank you for all your hard work over the past several months, and I look forward to--very much working with you in the years ahead. I

had a couple of questions, if you don't mind, and first is actually an issue that is pertaining to my district a bit. Over the past few decades, the EPA has made really admirable progress in attacking the lingering pollution and contamination issues in local municipalities that, left unchecked, would have dire long term health and safety consequences, not to mention financial ones.

Back home, in my district, just outside of Boston, the Fourth District of Massachusetts, I hear concerns about the cost of compliance with some of those regulations in almost every city and town I visit. They don't disagree with the importance of these regulations, but the communities struggle to get back on their feet post-recession, and deal with an already crippling loss of state and federal dollars due to our budget situation here. That price tag of compliance can seem nearly impossible.

In 1992, the city of Fall River was ordered to tackle a combined sewage overflow project that is estimated to cost them $185 million to date, along with 8 million in debt payments every year. This is an old industrial city, with an unemployment rate around 13 percent, median household income that struggles to break $30,000 a year. Similarly, Milford is looking at a $100,000 a year additional spending to meet new regulations for storm water management. They have also included a new pilot program to reduce phosphorus runoff in

local rivers and waterways, but the price tag around that is about $111 million up front, a price tag which, if borne by the town, would be felt tremendously by local businesses. The surrounding towns of Franklin and Bellingham are both looking at bills of about 75 million and 35 million respectively through the same pilot program.

When I talk to local officials and businesses, they want--they have a genuine desire to be EPA compliant. They are bringing up their children and grandchildren in these same neighborhoods, and they see the value of clean air and clean water. They are tremendously concerned about the effects of contamination, pollution, and other environmental hazards, and how they wreak havoc on their hometowns, and they know the associated costs of long term savings. But they are stuck, and so I wanted to ask you, in your opinion, is there any assistance that the Federal Government, not just the EPA, but the Federal Government, can give these already strapped municipalities that are struggling with the cost of compliance? And, again, I ask this, of course, given the--understanding the fiscal constraints that our government is under right now, but knowing that, obviously, this is an issue that is important to you as well. So if you could respond for a minute or so, I would be grateful.

Ms. MCCARTHY. Thank you for raising this, and your voice in this discussion would be really welcome. We are

working on these issues pretty diligently, primarily with the conference of mayors, because all of them understand these challenges, why it is important for their public health and their environmental resources that we tackle these more challenging water quality issues. But we are working on this on a number of different fronts, and EPA clearly has funds available to help support this. Is it enough to go around? No, it isn't. It is never expected to be. It will be a challenge. We try to prioritize that, and make sure that we are getting the biggest bang for the buck in helping those most in need.

So we are trying to work on a way to make a--this a much more collaborative process, where we understand the constraints that the cities and towns are in, and we don't expect things that they cannot deliver, but we work more in partnership to find the least cost opportunities to make continued environmental progress moving forward.

Mr. KENNEDY. Thank you. And then, Madam Administrator, if I can ask, and I apologize, I had to step out for a moment, but, my understanding, there has been two studies that have much discussed today. I can refer shorthand to them as the Harvard study and the ACS, American Cancer Society study, is that right?

Ms. MCCARTHY. Yes.

Mr. KENNEDY. You do understand me? Would you

characterize those institutions as reputable?

Ms. MCCARTHY. Yes.

Mr. KENNEDY. Well known?

Ms. MCCARTHY. Yes.

Mr. KENNEDY. Capable, and producing well-regarded and scientific study, other than these past studies?

Ms. MCCARTHY. I would.

Mr. KENNEDY. Have these two studies been peer reviewed?

Ms. MCCARTHY. Many times.

Mr. KENNEDY. By who?

Ms. MCCARTHY. By--through contractors for the agency, through the national community, through EPA.

Mr. KENNEDY. Through EPA? And sometimes through public/private partnerships?

Ms. MCCARTHY. Yes.

Mr. KENNEDY. And so that review, is that all government funded?

Ms. MCCARTHY. No.

Mr. KENNEDY. No? So, in fact, part of that funding was done by a group that was actually funded by automotive industry, is that right?

Ms. MCCARTHY. Yeah, many.

Mr. KENNEDY. Okay. Thank you. I yield back my time.

Chairman SMITH. Thank you, Mr. Kennedy. Mr. Kennedy, you have elicited the shortest answers of the day, so

congratulations to you. The gentleman from Indiana, Mr. Bucshon.

Mr. BUCSHON. Thank you. Thank you for being here. I just wanted to--a brief statement about bias. I am a cardiovascular and thoracic surgeon, so I know quite a bit about health, and I recently reviewed the data from the American Lung Association that they put out about particulate matter, and look at the background on the funding for all the studies, and, lo and behold, everything that they used was pretty much very far left leaning global warming activist foundations that privately funded these things. And, in addition to that, the potential health benefits are based on computer modeling, not on actual data, but a computer model projecting their data results into the future, not based on actual factual data, with human studies. And, to make matters worse, the computer modeling was developed by an individual who had a financial stake in the success of the model going forward. In fact, I had the Chief Medical Officer from the American Lung Association come down to--from New York and discuss this with him in my office, and voiced my disappointment that an organization that is so highly esteemed would be using data which, in my view, was biased.

But my question goes to--in another direction. In September your agency proposed a rule that represents perhaps the clearest, although not certainly the first, in the

administration's war on coal, what I will call war on coal. The Eighth District of Indiana, that I represent, has nine coal mines, every coal mine in the state, our state. 88 percent or so of our power comes from coal. Coal supports the economy, you know, jobs indirect and direct. It helps families put food on the table. In fact, my dad--I grew up in Illinois. My dad was a coal miner, so I have been--I have known this industry forever. In fact, I wouldn't be here because--if it wasn't for that.

But the new source--performance stands for new power plants will essentially prevent construction of another coal fired power plant in this country ever, essentially. In the few--in the first few pages of the EPA Cost Benefit Analysis, you admit that this policy will--and I quote, ''Result in negligible CO2 emission changes, or quantified benefits, through 2022.'' In your view, should the Federal Government regulate coal fired power plants in this manner if there are no clear benefits? That is an up or down.

Ms. MCCARTHY. We should be regulating CO2 from carbon emissions, yes.

Mr. BUCSHON. Then would you be--then your statement that you made in the--that was incorrect, that there is a benefit through 2022? Because the quote in the first few pages of the Cost Benefit Analysis says, and I quote again, ''Result in negligible CO2 emission changes, or quantified

benefits, through 2022.''

Ms. MCCARTHY. Which is a reflection of the industry and the market as it sits today.

Mr. BUCSHON. Okay. So what you are saying is they should regulate that, even in light of the fact the EPA admits there is no benefit to it?

Ms. MCCARTHY. The issue is that coal is not being invested in, except in a few instances where carbon capture and sequestration is being invested in, where--when we want to make sure that we take advantage of those new technologies, and make sure that we do what the Clean Air Act says, which is to underpin those reductions--

Mr. BUCSHON. Okay.

Ms. MCCARTHY. --moving forward.

Mr. BUCSHON. And that is fair, and I think the industry would agree that constant innovation and technological advances is something that the industry also--

Ms. MCCARTHY. Uh-huh.

Mr. BUCSHON. --believes in, as--and would--will invest in.

Ms. MCCARTHY. They do.

Mr. BUCSHON. That said, is the technology currently commercially available on a large scale for Indiana and the Midwest to meet the proposed standards?

Ms. MCCARTHY. On a large scale?

Mr. BUCSHON. Yeah. I mean, I don't, you know, there was, you know, you might quote that the technology is available in--

Ms. MCCARTHY. It is.

Mr. BUCSHON. --in some academic setting, or in an area of the country, say, where things are very close--but specifically, you know, related to CO2 emission capture, and all, you know, my understanding is currently there is not the commercially available on a large scale technology to comply, in Indiana, with the regulation. So the regulation is in place, but there is no commercially available technology to comply. Is that true or not true?

Ms. MCCARTHY. We believe that CCS is commercially available. Is it going to be broadly disseminated at this point? No, we don't believe so, because most of the facilities that are being constructed are actually natural gas facilities. They are the most competitive. But where coal is being invested in is being invested in with CCS.

Mr. BUCSHON. Thank you. I yield back.

Chairman SMITH. Thank you, Mr. Bucshon. The gentleman from California, Mr. Peters, is recognized for questions.

Mr. PETERS. Thank you very much, Mr. Chairman. And, Madam Administrator, thank you for being here. I should start by mentioning that the first job I had out of college was at the EPA in Washington, D.C.

Ms. MCCARTHY. Really?

Mr. PETERS. And I left to pursue other interests, and here I am back again with you, but it is nice to see you. And welcome, and thank you for your service. I wanted to ask about hydraulic fracturing, but, for context, I just wanted to call your attention to the work at the Institute for Strategy and Competitiveness at the Harvard Business School. Michael Porter and Jan Rifkin have done a study, what would make the United States the most competitive place to do business in the world? They have identified a lot of things we have heard about, like highly skilled immigration--or highly--immigration of highly skilled individuals, corporate tax reform, overseas profits, international trade, simplifying and streamlining regulation, improving communication and energy infrastructure, creating a sustainable federal budget, and the responsible development of American shale gas and oil reserves as an important component--

Ms. MCCARTHY. Um-hum.

Mr. PETERS. --of competitiveness worldwide. So, first, I wanted to ask you a little bit about--do you think that it is--that it is possible to develop these reserves responsibly? Is that the EPA's position?

Ms. MCCARTHY. I believe so.

Mr. PETERS. And if so--so, if so, tell me a little bit

about what you think the approach should be. And I want to give you a little bit of time, because I feel like I didn't get--you were interrupted sometimes when you were trying to give these answers.

Ms. MCCARTHY. Well, I--

Mr. PETERS. What is the--what should be the approach to the development of this? I would ask you to touch on two things in particular. One is the--obviously water and--water supply and quality, but also the emission of gases, including VOCs and methane, which is a super pollutant, and also how you would avoid double regulation? Because I understand there is other agencies in the Federal Government that may be doing things that are overlapping or inconsistent.

Ms. MCCARTHY. And there is a lot of State Governments working on this issue as well.

Mr. PETERS. Right.

Ms. MCCARTHY. I would, first of all, want to agree with you about the importance of the expanded natural gas availability. It has been a game changer in many ways, and it is important for our national security, as well as our continued ability to have all these energy resources available to us. So I think what EPA has been doing is in two ways. One is the President has been very clear about the fact that natural gas, and its availability, has been incredibly important to the country, but it also needs to be

done safe and responsibly.

And I think the committee knows that we are working on a very large project with other agencies of the Federal Government to look at water quality challenges, or implications, associated with hydro fracking, and new unconventional oil and gas exploration. We are in the middle of that study. Again, that is very robust. We have done a lot of outreach, webinars, and we are gathering as much information as we can, doing technical workshops. We expect that a draft will be out for peer review in the end of 2014. So we are tracking those issues, as well as responding to individual states when our technical expertise is being requested.

States are also the first line of responsibility in water quality, so we want to work in partnership with them to make sure that they are able to meet their own needs, and their--and fulfill--and get answers to their own questions, when they arise.

On the air quality side, we have a couple of things happening. We have actually already put out an air quality standard to address methane from emissions related to natural gas facilities--natural gas exploration, in particular fracking, at which time there are a lot of VOCs emitted. We can capture those. With that comes the methane. It can be re-used, and there is an ability to actually move forward in

a cost--a very cost-effective, and actually profitable, way to start gathering that methane as we are capturing the volatile organic carbons. We are looking at some other questions that have been raised about what else we should do, and we are looking at those issues, again, working in concert with other agencies, as well as states and local communities.

So while hydro fracking has raised concern about whether it can be done, or is being done, safe and responsibly, EPA is working with states, local governments, and the industry to make sure that we understand how to answer those issues effectively, from a science perspective, and in a way that continues to maintain the availability of inexpensive natural gas that strengthens this economy, as well as helps us reduce air emissions.

Mr. PETERS. And I appreciate that. I think that seems like a reasonable response. The one thing I would ask you, as a--someone who practiced environmental law for a long time--

Ms. MCCARTHY. Yes?

Mr. PETERS. --is please do what you can to work with the administration so we don't have overlapping and potentially inconsistent regulations? Very frustrating for the public, and we want it to be done responsibly. We also want it to be done in a way that people can understand. Again, thank you for being here, and thank you, Mr. Chairman.

Chairman SMITH. Thank you, Mr. Peters. The gentleman from Arizona, Mr. Schweikert, is recognized for his question.

Mr. SCHWEIKERT. Thank you, Mr. Chairman. Madam Administrator--and I really only had two things I wanted to walk through, and for everyone that was in a committee with us here yesterday, I am sorry, you are going to hear part of the same theme again. These large data sets that are used, particularly in things like PM10, which is a big deal for those us out in the desert, southwest, where we actually have this thing called dirt, you know, without grass on it, so it really does affect our lives.

Why is it so controversial, why is it so partisan, to put up the data? And what I mean is down to the individual, because you and I know, with all other types of data--you were a social anthropologist, so you--when you were being vetted, and doing, you know, review of data, you got down to the line item. If there was something personal there, you do a non-identifier number, you strip the personal data, and put those data sets up on websites, where it is egalitarian, where if a, you know, collectivist group, or a conservative group, or a business group, or a grad student could get it down to the line item data, and say, here is the noise from the data, but at least you have a communal international fight over this is good, this is bad, and who knows, you know, for those of us on the conservative side, it may not

yield what we think it will, or the liberal side, but at least there is that purifying effect of lots and lots and lots of people being able to drive their analysis through that--those data sets. Why is that such a difficult conversation to have around here?

Ms. MCCARTHY. I don't think there is anything political or controversial about making data available.

Mr. SCHWEIKERT. I should show you the tape from this committee from earlier in the year, where that was--it was stunningly a fight.

Ms. MCCARTHY. All the EPA is really trying to do is its responsibility under a number of laws, which is basically--we want to be supporting to the extent we can, openness, transparency, sharing information, sharing data--

Mr. SCHWEIKERT. But--

Ms. MCCARTHY. --meeting our--but--

Mr. SCHWEIKERT. Well--

Ms. MCCARTHY. May I just finish? The one thing I think we just need to have--make sure that there is a clear understanding is we have obligations to protect private information--

Mr. SCHWEIKERT. But there is a--

Ms. MCCARTHY. --and confident--

Mr. SCHWEIKERT. But I will tell you that in many ways that is a bizarre comment, because--do what everyone else

does. You strip the personal identifiers, and here is your data set.

Ms. MCCARTHY. We have--and we are actually asking those very same questions, and if you look--

Mr. SCHWEIKERT. Well--but--

Ms. MCCARTHY. --at the--

Mr. SCHWEIKERT. But how do you ask--and then use it as an excuse to not give us the data?

Ms. MCCARTHY. There is no--I am not trying to offer excuses, Congressman. I am trying to be as responsive as I can. But we need to just be careful in how we maintain that confidentiality. And we are working with--

Mr. SCHWEIKERT. But there is all--

Ms. MCCARTHY. --all of the researchers--

Mr. SCHWEIKERT. But there is--

Ms. MCCARTHY. --on this.

Mr. SCHWEIKERT. But, look, there is all sorts of protocols in that. I was involved in a very large project, where we were doing analysis of how much mortgage fraud had happened in the--in our communities, and those--we just did random identifiers, and then we put it out, and said, everyone study what happened. It is not hard. It is done every single--it is not that hard. And, if you are also using proprietary data, inappropriate. You are making public decisions, for the public, that affect the public, billions

and billions of dollars, maybe for the good, maybe to the bad. To use proprietary data, I believe, is--borders on perverse.

I have--something else I just want to show real quick, can we put up this slide? And this has sort of been my fixation of how we accumulate data, how we do analysis and study things. In my--Maricopa County and Gila County, Pinal County, I have a metroplex there with a few million people. We have PM10 and monitoring sites. And instead of putting monitoring sites where my population lives, we have chosen, you have chosen, under the rule sets--and I understand there may be a rule where, once it is there over a couple of years, it is really hard to move, because you lose the baseline data, but take a look at this one, just for the fun of it.

I--you have put, your predecessor, a monitoring site next to a very large stockyard, next to a railroad track, next to desert agriculture, and next to a series of dirt roads. Could you imagine the data you get from this monitoring site? Yet this is dozens, and dozens, and dozens, and dozens of miles away from where my population base is. How does that not create perverse skewing in your underlying data for trying to really build good quality statistics, particularly in PM10? This is an outlier, and you have two other monitoring stations that have almost the same attributes here. You are getting so much noise in your data,

this is where you--for those of us from sort of statistical backgrounds, we are just bouncing off the walls livid.

Ms. MCCARTHY. Well, I am happy to spend some time and bring my folks in, but when we do these rules, we also propose a monitoring plan, and we work with states. We take public comment on those plans as well.

Mr. SCHWEIKERT. My county, and my state, and my communities have been begging for years to put this in a rational spot, and have been ignored.

Ms. MCCARTHY. Well, we should have that conversation. But I do think our obligation is to look at ambient air quality across the country in a way that reflects the--

Mr. SCHWEIKERT. The population basis?

Ms. MCCARTHY. Well, actually, we do the--most of the monitors are done on a population basis.

Mr. SCHWEIKERT. So--

Ms. MCCARTHY. Some of these are not. Clearly this one was not one of them.

Mr. SCHWEIKERT. But this one didn't even hit the trifecta. It hit all four, you know, outliers. So--

Ms. MCCARTHY. But I appreciate your--

Mr. SCHWEIKERT. Madam Administrator--

Ms. MCCARTHY. --raising that point--

Mr. SCHWEIKERT. --sorry--

Ms. MCCARTHY. --and having that--

Mr. SCHWEIKERT. --but this is one that is just been a thorn in our side--

Ms. MCCARTHY. I actually--

Mr. SCHWEIKERT. --for--

Ms. MCCARTHY. --think I have been there before.

Mr. SCHWEIKERT. Well, in that case, you--I can't believe we didn't move it the next day. Mr. Chairman, I yield back.

Chairman SMITH. Thank you, Mr. Schweikert. The gentleman from Texas, Mr. Weber, is recognized.

Mr. WEBER. Thank you. Thank you, Ms. McCarthy, for being here. The Chairman, in his opening comments, said that the EPA should answer--he believes the EPA should answer the American people. Do you agree with that?

Ms. MCCARTHY. We work for the American people, yes.

Mr. WEBER. Good. Ms. McCarthy, have you ever run a business?

Ms. MCCARTHY. Have I ever--no.

Mr. WEBER. No? Okay. You said in your comments that you were here to talk about the central role the science plays--

Ms. MCCARTHY. Yes.

Mr. WEBER. --earlier today. And you--have you ever heard the statement that all science--scientists are only sure about one thing, and that is that every scientist before

them was wrong?

Ms. MCCARTHY. I have not.

Mr. WEBER. You have not heard that? Good, you--good. That is--you might learn--does the science ever change, or get proven wrong?

Ms. MCCARTHY. Sure. Yes, it does.

Mr. WEBER. Frequently, doesn't it?

Ms. MCCARTHY. I--

Mr. WEBER. So if you are here to talk about the central role the science plays in the EPA's deliberations, what would you say is the second thing that plays a role in the EPA's deliberations?

Ms. MCCARTHY. There are--if I could say three things?

Mr. WEBER. Quickly, please.

Ms. MCCARTHY. Science, law, and transparency.

Mr. WEBER. Science, law, and transparency? We are off to a good start. You said--and I don't remember when--who the exchange was with, submitted a rule--was it to OMBI?

Ms. MCCARTHY. OMB.

Mr. WEBER. OMB, Office of Management--

Ms. MCCARTHY. Office of Management--

Mr. WEBER. --and Budget. Okay.

Ms. MCCARTHY. Yes.

Mr. WEBER. But not to the Science Advisory Board? And, by law, as you said was the second thing that played a part

in you all's deliberations, behind science--or three things, then. So, by law, you are supposed to submit that same rule on the same date--or by that date, is that accurate?

Ms. MCCARTHY. I am not aware that that is specified in the law, but we certainly engage the SAB, and we have a--

Mr. WEBER. And you said you have a process of doing this. But if it is--if you are to submit it at the same time, or the same day, that is a pretty exacting science.

Ms. MCCARTHY. We actually sometimes consult with them even before it goes in the inter-agency--

Mr. WEBER. And you are to be commended. So if you don't submit that at the same time, as the objection was earlier, then, in essence, you are going around that law that you just said you are here to commit science, the American people, and following the law, right? So you are actually going around that law, so that exact science of the date--when you submit the law to OMB and the Science Advisory Panel at the same time, you are circumventing.

Ms. MCCARTHY. No, sir, I believe I am--

Mr. WEBER. You are not--so you are--

Ms. MCCARTHY. --the law.

Mr. WEBER. You are interpreting the law so that you have a--as long as you have the process, in effect, you are good?

Ms. MCCARTHY. No, sir, that--that is not what I--

Mr. WEBER. That is not what you said? Well, I misunderstood, I apologize. Let me go on. You said that there are researches that have contracts to verify data, in your earlier comments.

Ms. MCCARTHY. --contact--

Mr. WEBER. You don't recall that? Well, I was taking notes. So you have researches that have contracts to verify data, and my question is do you ever get biased results?

Ms. MCCARTHY. Well, actually, the--our entire peer review process is designed to minimize any possibility--

Mr. WEBER. Right.

Ms. MCCARTHY. --of that, and I think we do a good job at it.

Mr. WEBER. And so Chairman--Mr. Chairman--Mr. Hall mentioned Parker County earlier, where you had--or the EPA had to retract a statement where they said that they had--the--fracking has contaminated the water supply. Are you aware of that?

Ms. MCCARTHY. I am aware that the EPA developed data, and has provided that data publicly.

Mr. WEBER. Okay. And when Mr. Sensenbrenner questioned you on the standard for fuel efficiency, you said, pretty much quote, you aren't here to speak to manufacturers' warranties and liabilities.

Ms. MCCARTHY. I can't speak to their--

Mr. WEBER. Right.

Ms. MCCARTHY. --statements about that, no.

Mr. WEBER. So, in essence, if it affects an entire car industry, it doesn't matter--

Ms. MCCARTHY. Very much so it matters. It matters to us, and we--

Mr. WEBER. Okay.

Ms. MCCARTHY. --appropriate testing for that reason. I just can't--I am not--that is not my--

Mr. WEBER. Let me move quickly. Mr. Rohrabacher said, on grant recipients, he said--you said in response to him that you have procedures to ensure that they are fair-minded. Well, let me submit to you, as a business owner, if we are going to put businesspeople on the Science Advisory Panel, can't you apply those same procedures to make sure that they are fair-minded?

Ms. MCCARTHY. We provide the same procedure that is on--

Mr. WEBER. So you would be okay with having more business and industry experts on a panel, as long as they are fair-minded?

Ms. MCCARTHY. Our job is to balance that--

Mr. WEBER. Okay.

Ms. MCCARTHY. --panel out, and make sure they are doing their job correctly.

Mr. WEBER. Very quickly, I have Valero--a plant--

Ms. MCCARTHY. Yeah.

Mr. WEBER. --carbon capture sequestration in my--and I am Gulf Coast of Texas, District 14. $400 million was the cost of that project. Some 60 percent of that was supplied by the DEO through the--DOE through the ARRA, American Reinvestment and Recovery Act, stimulus. So you said that CCS had been demonstrated to be cost-effective in your exchange with--

Ms. MCCARTHY. No, I am sorry, sir, I said it was a reasonable cost.

Mr. WEBER. It was a reasonable cost? Okay. Well, let us go with that. So out of a $400 million, project, 60 percent of the--$240 million, if I have done--my high school math is holding up, is going to have to come from the Federal Government. Do you think it is reasonable to believe that industry can duplicate that, if 60 percent of the money has to come from the American taxpayers?

Ms. MCCARTHY. I think our analysis that has been put out, that we are taking comment on, would indicate that this cost is reasonable for new facilities moving forward.

Mr. WEBER. Okay. So when Congressman Neugebauer asked you if you had a cost benefit analysis, you said no, in essence you have done--you made a judgment decision about your analysis that it is reasonable?

Ms. MCCARTHY. Yes. It is a little--

Mr. WEBER. Okay.

Ms. MCCARTHY. --different that what we would look at as a--as being cost--

Mr. WEBER. I got you.

Ms. MCCARTHY. --effective. But--

Mr. WEBER. And then finally, very quickly, I know that they are--you are looking at new projected rules for ozone standards. When are those coming out?

Ms. MCCARTHY. I do not know the exact date, sir. It is in the middle of the process with our Clean Air Act Science Advisory Committee. I know that the next big step in that process is for them to look at a couple of documents that are--we are hoping to provide by the end of the year. We are past our 5 year time window--

Mr. WEBER. Okay.

Ms. MCCARTHY. --under the law, but we are working as hard as we--

Mr. WEBER. Would you--EPA seems to be in the business of mitigating hazards, so this might be a tricky question for you. Would you hazard a guess, will it be before November of 2014 or afterward?

Ms. MCCARTHY. I do not know the--

Mr. WEBER. And go through that?

Ms. MCCARTHY. It needs to be both proposed and

finalized, and I haven't even been briefed on that, because we are still looking at the science, and we like to keep the policy and legal questions--

Mr. WEBER. Okay.

Ms. MCCARTHY. --aside and work on the science.

Mr. WEBER. And if I may, Mr. Chairman, very quickly, you did a national survey to see willingness of people to pay?

Ms. MCCARTHY. We are talking about the 316(b)?

Mr. WEBER. Um-hum.

Ms. MCCARTHY. I believe it was a national--

Mr. WEBER. Okay.

Ms. MCCARTHY. --survey.

Mr. WEBER. Did you also survey industry to see if they were willing to pay for the EPA's opinion on whether or not it was cost-effective? And did you also do a survey to see if people were willing to pay for the loss of jobs when jobs are off--exported offshore because our plants can't compete? Did you do that survey?

Ms. MCCARTHY. I think we are mixing a little bit of apples and oranges, sir, and I don't know if there is time for me to clarify what the survey--

Mr. WEBER. Okay.

Ms. MCCARTHY. --actually was doing, and in what rule it was applying.

Mr. WEBER. We will talk offline.

Ms. MCCARTHY. Okay.

Mr. WEBER. Thank you.

Chairman SMITH. All right. Thank you, Mr. Weber. The gentleman from Utah, Mr. Stewart, is recognized for his questions.

Mr. STEWART. Thank you, Madam Administrator, for being here today. I am sure you have just enjoyed your morning. You have been looking forward to this--

Ms. MCCARTHY. This is--

Mr. STEWART. --for weeks, I hope.

Ms. MCCARTHY. --part of the public process, and I am honored to be here.

Mr. STEWART. Well, thank you, and I am sincere when I say I think we recognize that you have worked hard to serve your country. But there are so many things that you and I disagree with, and that I believe that the EPA is working not for, but actually against the best interest of the American people. And some of those, not all of them, but some of them have been brought up to date in this hearing so far, and let me just list a few of them quickly. Your interpretation of navigable waters, and--with the Clean Water Act, RFS standards and the fuel--new ozone standards that my friend, Mr. Weber, mentioned there very quickly. It is going to affect huge parts of the West.

Hydraulic fracking and clean water, new standards for the human cost of carbon emissions, and standards that--as we have spent some time with--talking about coal fired power plant generation. All of these things, and there are others, taken together, I believe that these new rules and proposals make life harder for hardworking American families. They take away economic freedom. They take away economic opportunity, I believe, and they have the effect of making Washington D.C. more and more powerful, and more and more central to Americans' lives. And I think, frankly, that they make the American people less trustful of Washington D.C., and less trustful of the government, and I am sure you have a sense of that as well. And very clearly some of the questions and concerns expressed in this hearing today indicate that to you.

But let me focus on just one of them, if I could, and it is not a particularly partisan issue. It will affect Democratic and Republican districts. It will affect Democratic and Republican states. And I will start with a very simple question, and that is--and it is not intended to be a gotcha question at all, but do you think it would be appropriate for the EPA to propose a standard that would be impossible to meet?

Ms. MCCARTHY. If it is a health based standard about what is healthy, and impacts associated with it, we need to

rely on the science to say that.

Mr. STEWART. Well, I understand, but, again, would you propose a standard that would be impossible to meet? Would that be appropriate for the EPA to do?

Ms. MCCARTHY. It really depends on what the question is.

Mr. STEWART. Well--

Ms. MCCARTHY. If it is a health based standard, you set the standard based on the health impacts--

Mr. STEWART. But once--

Ms. MCCARTHY. --and then you--

Mr. STEWART. --again, Madam Administrator, if it is impossible to meet, it doesn't matter what the--what your standard might be, if it is impossible. And I think everyone would recognize that.

Ms. MCCARTHY. Well, we would not require the impossible, sir.

Mr. STEWART. Okay, and that--and I appreciate that, and that is what I was hoping you would say. And it wouldn't be appropriate for the EPA to set standards, for example, that are actually below naturally occurring background levels. And if I could call your attention to a slide, and I suppose you have seen this, or something like this before, regarding ozone standards. The areas in red reflect EPA controlled monitor counties where a 60 parts per billion standard would

be violated. Areas in orange indicate unmonitored counties that anticipate the violation of the 60 parts per billion.

And, look, we are--if you see that--I represent parts of Utah. We have got, you know, some of the most remote--they are very beautiful, but they are some of the most unpopulated areas of our nation. Zion's Canyon, Bryce, canyon lands. You could include Yellowstone National Park in this map as well. And yet, using Yellowstone as an example, naturally occurring ozone, 66 parts per billion, which is above what some of the proposed standards are where--are being considered. And I guess I would just ask you, are you aware that some of the most remote, and in some cases pristine parks and parts of the country will be--have ozone that exceeds the range of this proposed standard?

Ms. MCCARTHY. There is no proposed standard at this point, Congressman, let us just make sure that people aren't confused by that. But I would also say that I know the Science Advisory Board is looking at this issue with the staff so they can establish some recommendations to me moving forward--

Mr. STEWART. Yeah.

Ms. MCCARTHY. --and we can take a look at these issues.

Mr. STEWART. And I appreciate--okay, maybe there isn't a proposed standard. I--maybe this is one of those issues that depends on what the meaning of the word is is, and we

could go back to very technical definitions, but there is certainly some consideration of a standard of 60 parts per billion, would you agree with that?

Ms. MCCARTHY. I honestly do not know whether that is part of the consideration--

Mr. STEWART. Okay.

Ms. MCCARTHY. --that the Science Advisory Board will advise me on.

Mr. STEWART. Okay. In hearings that I chaired earlier this spring, we were very clearly told that that was the standard that they were considering. And, in fact, that they were not only considering, it was one that they were leaning towards, and we expected it to be the new proposed standard.

Ms. MCCARTHY. Okay.

Mr. STEWART. If--I guess I would just conclude with this, my time being ended, and I wish I had more time, but there is nothing that these Western states can do to achieve that kind of standard. It will have great economic cost. By the EPA's own estimate, $90 billion. By some estimates, it may be 10 times that amount. And it would--I would love to talk to you another time about the--just the wisdom, or the sanity, frankly, forget wisdom, just the sanity of the EPA proposing a standard that is impossible to meet, that would be incredibly expensive. And, once again, coming back to my

opening statement, and--why that generates so much suspicion--

Ms. MCCARTHY. Yeah.

Mr. STEWART. --and so much ill will in the body politic of the American people. So, with that, thank you, Mr. Chairman, and I yield back my time.

Chairman SMITH. Thank you, Mr. Stewart. The gentleman from Oklahoma, Mr. Bridenstine, is recognized for his questions. Sorry. He is not here. We will go to the gentleman from Texas, Mr. Stockman.

Mr. STOCKMAN. Well, hi, Ms. McCarthy. I am over here.

Ms. MCCARTHY. Thank you.

Mr. STOCKMAN. I know, we are kind of jumping around. I think, though, you earlier gave me my favorite tweet of the day, which I want to--and--which is, I am lucky enough--really? Let us--the quote is--from you, I love it. It says, I am lucky enough not to have to sign up for Obamacare. That is wonderful. I wish my constituents could say the same.

Ms. MCCARTHY. I actually think I was referring to I am lucky enough to have access to good health care, which the--

Mr. STOCKMAN. I still will take your quote--

Ms. MCCARTHY. --Affordable Care Act--

Mr. STOCKMAN. --from the record.

Ms. MCCARTHY. --will expand.

Mr. STOCKMAN. I wrote it down. It is really good. There is--you said also in your testimony there was $2 billion in new jobs from your EPA. I want to point out that one facility alone in my district is a $7 billion--$7 billion in new construction, representing 13,000 jobs, and your administration is saying, because of the 2 week furlough, that it is going to take many more months to look at the permits. And I would request that, given the circumstances of our poor economy, and the fact that this needs to be done, it is meeting, I believe, all the EPA requirements, I would ask that you, and I will follow up with you, that you look at this and expedite it. It is 12,000 jobs. That is a lot of jobs.

Ms. MCCARTHY. I am sorry--

Mr. STOCKMAN. And I just--

Ms. MCCARTHY. --what kind of permit are we talking about?

Mr. STOCKMAN. EPA permit. It has been in your office, it has been sitting there. They have followed all the rules and regulations.

Ms. MCCARTHY. I am happy to follow up.

Mr. STOCKMAN. I would appreciate it. There is also another plant that wants to export coal, so it won't be burned here, in my district. Altogether we have $52 billion that is being held up by the EPA, which, by the way, is more

than the sequester. I am just saying to you that there is a lot of jobs in my district that is dependent, unfortunately, by your decisions, and I would like to give the information to you so we can facilitate the jobs that I know this President wants. He is the jobs president, and I really want to help him out in doing that.

And this much activity in our district, which--Texas, as you probably know, represents almost 50 percent of all the jobs in the United States that are created. And in my district, we have had 30,000 people move into our district. There has been over a million wells fracked, as you know. There has been a lot of fracking. And there is a general history in this United States of people independently drilling for oil and producing products that this nation relies on. We are going to produce more oil than Saudi Arabia, and I think it is because of the independence and the drive of this American spirit.

I just want the boot off the neck of the Americans so we can see a future where we have independence from the Middle East. This has great implications on our foreign policy, great implications on people's future. And I am real frustrated when I come back to my district, and I have people coming to my town hall meetings and saying, we want the jobs. And I have to tell them, I am sorry, but someone from the EPA is not letting us have the jobs. I am just begging you,

please, open your heart up, get these permits done. They have done the work. They have complied with all the regulations. I don't see what it is--for 2 weeks they said we shut down the government. It shouldn't take months to recuperate the 2 weeks that is lost.

And, I don't know, I even have a plant, that is not in my district, but a lead plant--now all the lead plants are closed in the United States. They were willing to spend $100 million upgrading the lead plant. Now the Chinese are going to produce the lead, so now we are not going to have the lead for the Americans to put on their, you know, when you get X-rays, they will come from China. The batteries, the lead will be coming from there.

I just--I am really frustrated that we have so much opportunity in this country, and again, and again, and again, it comes back to your administration, where I hear, okay, it is locked up there, it is locked up there, it is locked up there. And I go to town hall meetings--I would love for you to come with me, and I will invite you to a town hall meeting where we can share the podium, and hear from the people individually who are losing their jobs because we can't get permits.

And I am troubled that, again, time and time again, I can't get any satisfaction, quoting from The Rolling Stones, of course, from your administration. So if we could work

together--

Ms. MCCARTHY. --to sing.

Mr. STOCKMAN. Yeah.

Ms. MCCARTHY. I appreciate it.

Mr. STOCKMAN. Go for it. But if we could work together on this, I would appreciate it. And I--and I will welcome you to any town hall meeting.

Ms. MCCARTHY. You know, this is an issue that, frankly, I just have not heard for a long time. I think we have been trying to do our best to expedite permits as much as we can, knowing the economic implications of that. So if you do have concerns, we really should tackle them together.

Mr. STOCKMAN. I appreciate it. Thank you. Thank you, Mr.--I have got one thing I want to add.

Ms. MCCARTHY. Yeah?

Mr. STOCKMAN. This is for my colleague, who wanted to clarify--Dana Rohrabacher. It is my--quick clarification on the CRS report, and place this into the record, if I can, Mr. Chairman.

Chairman SMITH. Okay. Without objection.

Mr. STOCKMAN. Okay. Thank you.

Chairman SMITH. Okay. Thank you, Mr. Stockman. The gentleman from Kentucky, Mr. Massie, is recognized.

Mr. MASSIE. Thank you, Mr. Chairman. Madam Administrator, throughout this hearing you have pounded the

importance of transparency, and I agree. Consistent with your promise of transparency, on September 30, 2013 your agency announced it would hold public listening sessions on reducing carbon emissions from existing power plants to consider the public concerns ahead of development of the EPA rules. But I was disappointed to learn that all of the EPA's 11 announced sessions are in major metropolitan areas, and none of these listening sessions would be in the 10 states most reliant on coal.

In November, our Congressional delegation sent you a letter, informing you that Kentucky's already lost more than 6,200 coal jobs in just the last 2 years, reducing the state's coal employment to its lowest level since the Commonwealth began keeping statistics in 1927. Unfortunately, these jobs--job losses are forecasted to continue, to increase, as additional EPA regulations targeting coal come online. In this letter, we requested that you hold listening sessions in Kentucky for the sake of openness and transparency that you have espoused today. In the eyes of Kentuckians and American people, will you commit to us today that the EPA will hold listening sessions in the Commonwealth of Kentucky, and other similar states, like North Dakota, where my colleague, Mr. Cramer is from, that are reliant on coal production and coal fired electricity as you seek public comment?

Ms. MCCARTHY. Well, Congressman, we received a number of requests for additional listening sessions. I would like to explain to you, those 11 sites are actually our regional offices, because it is--

Mr. MASSIE. Certainly you--

Ms. MCCARTHY. --helps us--

Mr. MASSIE. We appreciate that, and we appreciate that you have held before listening sessions outside of your offices. I think you should get outside of the office, you know, go out and see the people you are going to affect once in a while. And hopefully you certainly must realize that if you fail to hold these listening sessions on greenhouse gas regulations in the states whose economies most depend on the coal industry and coal fired electricity, this will be perceived as an effort to avoid negative public opinion--

Ms. MCCARTHY. Well, there--

Mr. MASSIE. --or to ignore the adverse effects of these regulations.

Ms. MCCARTHY. I--

Mr. MASSIE. You realize that is going to be perceived that way if you don't hold these hearings?

Ms. MCCARTHY. Well, I think people should recognize that this is even before we are proposing, never mind entering into the rigorous public--

Mr. MASSIE. Can you commit--

Ms. MCCARTHY. --comment process--

Mr. MASSIE. --today--

Ms. MCCARTHY. --without making--

Mr. MASSIE. --to hold this in Kentucky?

Ms. MCCARTHY. There is also opportunities for individuals to--

Mr. MASSIE. Okay, I can't let you take all of my time if you won't answer the question. You know, smog and most other air pollution is a function of urban concentration. In fact, the EPA has recognized 66 of 3,000 counties in the United States as having air quality issues. Those are urban issues, for the most part. So residents of rural areas, like myself, who rely on wood heat as an affordable, abundant, renewable, and you will like this, carbon neutral source of heat energy, are perpetually perplexed by the EPA's fascination with regulating this form of heat, since it is primarily a rural form of heat. And we believe that a one-sized fits all rule on wood heat that comes from Washington D.C., from bureaucrats who have never experienced the warmth of the heat that comes from wood, or maybe even the exercise of collecting it themselves, really aren't qualified to regulate our source of energy, especially when they are taking away our other sources of energy.

Let me read from you--read for you from the EPA's website on these new rules that are being proposed. Or maybe

this is pre-proposal, but this is certainly from your website. EPA--quote,''EPA is revising the new source performance standards for new residential wood heaters.'' I will skip some of it. ''This action is expected to include the following new residential wood heating appliances, wood heaters, pellet stoves, hydronic heaters'', and the list goes on.

Ms. MCCARTHY. Um-hum.

Mr. MASSIE. And then it finishes with this, ''These standards would apply only to new residential wood heaters, and not to existing residential wood heating appliances.''

Ms. MCCARTHY. Right.

Mr. MASSIE. Is that your impression, that these rules would just apply to new heaters?

Ms. MCCARTHY. That is all they do apply to, yes.

Mr. MASSIE. Okay. So you can promise us--

Ms. MCCARTHY. It would apply to--

Mr. MASSIE. You can promise us today that if Americans like the wood stove they have, they can keep it, period?

Ms. MCCARTHY. This particular part of the Clean Air Act does not address existing for this--these types of pollutants. And the only thing--

Mr. MASSIE. Let--I have one more question, and only 30 seconds to ask, but I am glad that you can assure us we can keep that if we like it, period, and I hope that is a promise

you can keep. There is one other issue that affects rural America that just has us scratching our heads. I hope it is an urban legend. Is anybody in the EPA really looking at regulating cow flatulence?

Ms. MCCARTHY. Not that I am aware of.

Mr. MASSIE. Okay. Yeah, because we have heard that on farms, are aware of that, at the USDA?

Chairman SMITH. Pardon me? You have heard it what?

Mr. MASSIE. That--the methane emissions from cattle, can you--

Ms. MCCARTHY. Yeah.

Mr. MASSIE. --assure us today that you are not--

Ms. MCCARTHY. I am not looking--

Mr. MASSIE. --investigating that?

Ms. MCCARTHY. --at that.

Mr. MASSIE. Nobody in the EPA is? Thank you very--

Ms. MCCARTHY. Not that I am--

Mr. MASSIE. --much.

Ms. MCCARTHY. --aware of.

Mr. MASSIE. Thank you. And I yield back.

Chairman SMITH. Thank you, Mr. Massie. The gentlewoman from Wyoming, Ms. Lummis, is recognized.

Mrs. LUMMIS. Thank you, Mr. Chairman. Welcome, Administrator.

Ms. MCCARTHY. Thank you.

Mrs. LUMMIS. In your agency's recently re-proposed new source performance standards for power plants--

Ms. MCCARTHY. Yeah.

Mrs. LUMMIS. --you set levels for coal fired plants based on the use of carbon capture and sequestration technologies. You did not require that same technology for gas fired power plants.

Ms. MCCARTHY. Yes.

Mrs. LUMMIS. By requiring CCS for coal units only, aren't you applying a standard that is higher regarding the carbon that is emitted from coal generated power? It just sounds to me like this is not an all of the above energy plan. It singles out coal for punitive treatment. Can this really be defended as a transparent and equitable application of the Clean Air Act? I like the administration, that you have testified, supports opportunities in natural gas. So do I, and I support them also for new coal fired plants, and coal--all the reasons that EPA gives for declining to find CCS technologies to be the best system of emission reduction for gas fired units apply with equal force to coal fired units. So why require it for coal?

It strikes me that the answer to that question is to set a precedent. EPA is under a consent decree to issue new source performance standards on greenhouse gases for refineries in the near future. Will that rules best system

of emission reduction also require implementing technology that is unproven on a commercial scale? That seems to be the new definition of adequately demonstrated. When EPA requires a technology for new coal plants that is not yet in commercial operation, what is to stop it from doing the same for other sources of carbon?

I might add that earlier, in response to Mr. Neugebauer, you said that CCS technology is ready, according to the DOE. But DOE was in front of this committee in the summer, and they couldn't give us a date for the technology to be ready. And then former Secretary of Energy McConnell was here 2 weeks ago, and he testified that commercial CCS technology currently is not available to meet EPA's proposed rule. So our problem is this committee has received conflicting testimony from the former Secretary of DOE at your sister agency.

I find it interesting that the EPA claims that, regardless of this new rule, no one plans to build traditional coal plants. So does this rule achieve any of the EPA's carbon reduction goals? By its own admission, EPA is requiring carbon reducing technology for plants that will never be built. But, at the same time, it is requiring no reductions from new natural gas plants, even though they are being built in greater numbers than ever before. This doesn't make sense to me, and I just want to ask if it makes

sense to you.

Ms. MCCARTHY. What--could I address the issues that you have raised?

Mrs. LUMMIS. Yes.

Ms. MCCARTHY. Okay. In terms of why we wouldn't be proposing CCS on natural gas, we do not have the kind of wealth of data that we have for the demonstration of CCS on natural gas as we do on coal. We know they run differently. We know the technology is different. We know the--that the gas stream for natural gas is different. We did not have the data available to be able to propose CCS on natural gas. We went with what we knew to be demonstrated technology moving forward. We do have data on the coal side that addresses the requirements we have for being robust. But we will look at comments that come in.

Relative to DOE, I think the DOE employees have been--and staff, as well as the Secretary, have been very supportive of the way we are looking at the data in this industry sector moving forward.

Mrs. LUMMIS. Thanks. I want to squeeze in one more--

Ms. MCCARTHY. Okay.

Mrs. LUMMIS. --question before I run out of time.

Ms. MCCARTHY. Okay, sorry.

Mrs. LUMMIS. That is okay. Let us--let me ask you--this is kind of a yes or no question. Is it EPA's view

that Section 111(d) of the Clean Air Act gives states primacy in the development and implementation of new source performance standards for existing power plants?

Ms. MCCARTHY. Yes, it is state implementation plans that need to be developed.

Mrs. LUMMIS. Thank you. So now you have 3 seconds to answer my previous question.

Ms. MCCARTHY. Well, the only other one I wanted to hit was this idea that we are not going to be making any progress moving forward because most of them are natural gas. The--what we are trying to do is make sure that new facilities, like power plants, that are around for 60 or 70 years take advantage of the technologies available to them today so that they can be part of the mix moving forward.

Mrs. LUMMIS. Thank you.

Ms. MCCARTHY. Coal is important now. It will be in the future.

Mrs. LUMMIS. Thank you very much.

Chairman SMITH. Thank you, Ms. Lummis. The gentleman from North Carolina, Mr. Cramer, is recognized for questions.

Mr. CRAMER. The--I am sorry, did you say from North Dakota?

Chairman SMITH. Yes.

Mr. CRAMER. Yeah, I thought you did.

Chairman SMITH. I thought I said North Dakota.

Mr. CRAMER. Thank you, Mister--

Chairman SMITH. I misspoke if I said anything other than North Dakota.

Mr. CRAMER. That is fine. Thank you for being here today, and I want to ask some questions about the hydraulic fracturing study. But before I do that, I want to follow up on Mr. Massie's invitation to--for you to go to Kentucky and hold a listening session on your way to North Dakota to hold a listening session on the new source performance standards. I would--I would like to submit my letter of invitation to you of October 18 into the record, if I could, Mr. Chairman?

And it just seems like, in the spirit of transparency, that having these 11 listening sessions in the cities where you, granted, have regional offices, is okay as far as it goes, but what a wonderful opportunity it would be to add some more listening sessions. And so I would really love to have you commit to considering these other places, including Bismarck, North Dakota.

Ms. MCCARTHY. I appreciate that. And I just want to tell you that that is not the extent of what we are doing. Those are the major listening sessions, but the regional offices and our administrators are really branching out to the individual states.

Mr. CRAMER. And I understand that, but I also

understand that, in a place like North Dakota, where there are 17,000 jobs at stake, $3-1/2 billion toward our economy is at stake, and where there are a whole bunch of really wonderful smart experts and scientists who work in this every single day, could provide lots of good information to the EPA, that a better--might be to hold a listening session there in public view, for everybody to participate. So I would appreciate--in fact, I would love it if you would just come in--we will work out the details later as to, you know, what time and what cities, and all of that.

But I also want to get into the hydraulic fracturing study that you are engaged in, because I have some concerns about it, especially the study designed and some of the goals of the study. Because, as we have discussed in this committee previously with other witnesses, this idea of the EPA searching for what is possible without attention to what is probable is problematic from--I think from a real scientific standpoint, because one of the primary goals of the study--stated primary goals of the study is to answer questions, like, what are the possible impacts of hydraulic fracturing, fluid surface spills, on--near well pads, on drinking water resources, end quote.

And it appears, in fact, the EPA's independent science advisory board shares this concern as well. One SAB expert comment, ''There is no quantitative risk assessment included

in EPA's research effort. Thus, the reader has no sense of how risky any operation may be in ultimately impacting drinking water. This is also a significant limitation of the work.'' Is the mere possibility of an event occurring sufficient to justify regulatory action, in your mind?

Ms. MCCARTHY. I actually think that this is purely a scientific research project so we understand the potential implications. It is not a regulatory decision.

Mr. CRAMER. Sure, but with--again, the possible versus probable, as--what is the standard, then, of probability before you continue with more years and more resources, given the fact that hydraulic fracturing is not exactly a new technology? I mean, it is--

Ms. MCCARTHY. No, it has been around--

Mr. CRAMER. --been around for--

Ms. MCCARTHY. --for a while.

Mr. CRAMER. --over half a--

Ms. MCCARTHY. Yeah.

Mr. CRAMER. --century.

Ms. MCCARTHY. Yeah.

Mr. CRAMER. So, I mean, is there a line--and you certainly can understand why industry and states might be concerned that we are down this path, with the mere possibility as a standard, and the uncertainty that that creates in the investment community as we try to become more

energy security in this country.

Ms. MCCARTHY. My understanding is that this is a number of research projects that are looking at the potential for impact on water supplies. It is the first step--

Mr. CRAMER. I understand--

Ms. MCCARTHY. --in looking--

Mr. CRAMER. --but, in fact--

Ms. MCCARTHY. --at this in a more comprehensive way so we can be sure we are doing things safe and--

Mr. CRAMER. While I agree that this is one, and this--I guess part of something more comprehensive, because your Office of Science Policy director, Dr. Hoffman, in May of last year, stated that the agency was doing ''a pretty comprehensive look at all the statutes to determine where holes may allow for additional federal oversight.'' So is this study part of that comprehensive look for holes and opportunities to regulate further?

Ms. MCCARTHY. My understanding is, and we can certainly follow up, is that this is purely a research project. It is not, at this point, talking about what laws we might utilize, or what regulations we might want to do.

Mr. CRAMER. Well, have you found any holes, or do you know of any regulatory holes that might present an opportunity for further regulation by the EPA? Because, you know, that standard is rather frightening in North Dakota.

Ms. MCCARTHY. I--we are purely looking at whether or not there are implications that we need to understand from hydraulic fracturing both--in this case on water quality. That is it.

Mr. CRAMER. All right. Thank you, and my time is expired, Mr. Chairman.

Chairman SMITH. Thank you, Mr. Cramer. The gentleman from Florida, Mr. Posey, is recognized for his questions.

Mr. POSEY. Thank you, Mr. Chairman, and thank you, Madam Administrator, for your testimony today, and it has been largely direct responses, and I really appreciate that.

Ms. MCCARTHY. Thank you.

Mr. POSEY. Following up on some of the questions that we had earlier today concerning science based management, how many Ice Ages have we had on this planet, do you know?

Ms. MCCARTHY. I am sorry, sir, I don't.

Mr. POSEY. Okay. I have read different things. Some say three, some say five. Do you think we have had Ice Ages before?

Ms. MCCARTHY. I am quite sure of reading about those, but I am not a scientist, and I don't want to pretend to be for you, sir. But we can get our scientists to respond, if you want a more direct--

Mr. POSEY. Yeah, I really would like that. You know, normally you can't have seamless Ice Ages. You must have a

warming period between the Ice Ages, and I was just wondering if you happen to know what the temperature was here on Earth between the last two Ice Ages.

Ms. MCCARTHY. I am sorry, sir, I can't answer those questions.

Mr. POSEY. Okay. If I told you the Earth was 30 degrees warmer before the last Ice Age, would that surprise you, or--

Ms. MCCARTHY. It would not influence my decision, in terms of listening to the science and the consensus around climate. I leave the science to the scientists.

Mr. POSEY. But don't you think the history of the Earth should have some bearing on science?

Ms. MCCARTHY. I am sure that it does.

Mr. POSEY. But--

Ms. MCCARTHY. I just don't want to pretend that I am a scientist and have that discussion with you, sir, because I am not. I do listen to the scientists, and I look--listen to the consensus that is being drawn.

Mr. POSEY. Well, I listen to scientists too, and I don't claim to be a scientist, but I don't want to put my head in the sand and--

Ms. MCCARTHY. Um-hum.

Mr. POSEY. --ignore what science--

Ms. MCCARTHY. I am not.

Mr. POSEY. --is inconvenient.

Ms. MCCARTHY. I am listening.

Mr. POSEY. And now--I was just wondering what impact you thought carbon emissions had on previous global warming between Ice Ages?

Ms. MCCARTHY. The information that I have available to me relates to all of the work that is done by the number of scientists looking at the climate issues. And I pay attention to that, and I will apply the science in decisions moving forward. I am not either comfortable or qualified to have a science discussion with you on these issues.

Mr. POSEY. Do you see the promulgation of any rules that would enact a carbon tax in the future?

Ms. MCCARTHY. Say that again, sir?

Mr. POSEY. Do you see the promulgation of any rules that would enact a carbon tax for this country in the future?

Ms. MCCARTHY. Only if Congress provides a--provides that mechanism, no.

Mr. POSEY. Okay. Mr. Chairman, I can't get my questions answered, so I guess I am pretty much finished and yield back.

Chairman SMITH. Thank you, Mr. Posey. I don't believe we have any other members with questions, so, Administrator McCarthy, thank you for your presence today. And we may have additional questions that would be submitted to you in

writing. We hope you will reply to those in the next couples of weeks.

Ms. MCCARTHY. Mr. Chairman, can I ask you one favor?

Chairman SMITH. Of course.

Ms. MCCARTHY. I know you asked me a lot of information in the front about the subpoena issues.

Chairman SMITH. Yes.

Ms. MCCARTHY. I want to make sure that we both understood one another, so if we could meet afterwards? I want to make sure that I gave perfectly correct answers, and that our expectations are the same on what you are looking for, and whether or not we have complied with that, and what you are looking for next.

Chairman SMITH. Okay.

Ms. MCCARTHY. I want to be very respectful of you, and the wishes of this committee.

Chairman SMITH. Thank you. Well, I am somewhat encouraged by some of your answers today, and I hope you will give us the data that we would like to have, and that we would like to have independently verified. I am not sure it is true or not, but didn't you once tell us, if you like it, you can have it? I am just teasing. Thank you for your appearance today. We stand adjourned.

[Whereupon, at 12:35 p.m., the Committee was adjourned.]

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SPEAKER LISTING

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Congressional Research Service

MEMORANDUM March 12, 2013

To: House Subcommittee on Energy and Environment, Committee on Science, Space and Technology
Attention: Clint Woods

From: Linda-Jo Schierow, Specialist in Environmental Policy, 7-7279, lschierow@crs.loc.gov

Subject: **EPA Grants to Members of Selected EPA Advisory Committees**

This memorandum responds to your request for information about current and past grants from the U.S. Environmental Protection Agency (EPA) to members of the following two federal advisory committees that serve the EPA:

- Clean Air Scientific Advisory Committee (CASAC); and
- Science Advisory Board (SAB).

The results were obtained by searching the EPA's National Center for Environmental Research (NCER) Project Database. Members of each committee and the amounts and titles of grants that supported their work are listed in **Table 1**, organized by committee. It is important to note that only EPA research grants are included in Table 1. The table excludes state and local government grants (some of which may ultimately be funded by a federal grant to the state or local entity), as well as grants provided by the private sector, although some committee members have received such grants.

Another key clarification is that while we refer to these grants as being "to" particular committee members, in fact they typically are to the academic institution where the member is employed, and only a very small proportion, if any, of the grant may be paid in the form of salary to the member. Committee members were identified only if they were listed as Principal Investigators or Co-Investigators, whose role generally is to lend expert advice and to oversee work done by graduate students or post-doctoral fellows. In some cases, grants are for major national research centers that house numerous research projects and potentially involve dozens of students and post-doctoral fellows and several professors. Funding for specific projects supported by these centers is not specified in the NCER database and not reported in Table 1. Similarly, some research grants were for projects that are funded through the public-private Health Effects Institute or university consortia known as Hazardous Substance Research Centers. The latter centers were established under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) section 311(d) and are jointly funded by EPA and the National Institute for Environmental Health Sciences. NCER does not provide funding information for these projects, and Table 1 does not include such information.

Finally, it is also important to note that grants may be listed more than once if they were received by several committee members. In addition, some grants are provided by multiple agencies, and the multi-agency total for the project may be stated in the database, although only a portion of the funding derives

from EPA's budget. For this reason it would be inappropriate to sum the grant amounts to obtain a total EPA funding amount across committee members or for any single committee member. Grant amounts are rounded to the nearest $1,000.

I hope that you find this information useful. Please call me if you would like further assistance.

Table 1. EPA Grants to Members of Two EPA Advisory Committees

Member	Affiliation	Grants
Clean Air Scientific Advisory Committee (CASAC)		
Frey, H. Christopher (Chair)	North Carolina State University (NC)	2010-2013, $500,000 - Framework for Context-Sensitive Spatially- and Temporally-Resolved Onroad Mobile Source Emission Inventories
		2008-2011, $893,000 - Spatial temporal analysis of health effects associated with sources and speciation of fine PM
		2004-2009, $680,000 - Advanced Modeling System for Forecasting Regional Development, Travel Behavior, and Spatial Pattern of Emissions
		1998-2001, $553,000 - Development and Demonstration of a Methodology for Characterizing and Managing Uncertainties in Emission Inventories
		1998-1999, $180,000 - Methods for Assessment of Pollution Prevention Technologies
		1998-2001, $329,000 - Probabilistic Modeling of Variability and Uncertainty in Urban Air Toxics Emissions
Allen, George A.	Northeast States for Coordinated Air Use Management (MA)	1998-2003, $3,000,000 - Investigations of Factors Determining the Occurrence of Ozone and Fine Particles in Northeastern USA
		1996-1999, $380,000 - Development and Validation of a Novel Technique to Measure Ambient Particle Properties: Bound Water, Mass Density, and Mean Diameter
		1998-2000, $527,000 - Time-Relevant Communication of Ozone and Particulate Air Pollution Data: A Pilot Project to Raise Public Awareness and Promote Exposure Reduction
Diez-Roux, Ana	University of Michigan (MI)	2011-2012, $556,000 – Center for Integrative Approaches to Health Disparities – Environment Assessment Core
		2006-2009, $576,000 - Heat-related Hospital Admissions Among the Elderly: Community, Socio-economic and Medical Determinants of Vulnerability and Economic Impacts
		2004-2014, $32,999,000 - Prospective Study of Atherosclerosis, Clinical Cardiovascular Disease, and Long-Term Exposure to Ambient Particulate Matter and Other Air Pollutants in a Multi-Ethnic Cohort
		2003-2006, $769,000 - Long-term Exposure to Ambient Particulate Matter and Subclinical Atherosclerosis
Harkema, Jack	Michigan State University	2011-2013, $600,000 – Environmental Transformation and Biological Fate of Fresh and Aged Cerium Oxide Nanoparticles
		2011-2013, $8,000,000 – Great Lakes Air Center for Integrative Environmental Research
		2005-2010, $8,000,000 – Southern California Particle Center
		2004-2007, $748,000 – Estrogen Elicited Gene Expression Network Elucidation in the Rat Uterus
		2001-2004, $855,000 – Effects of Airborne Particles on Allergic

Member	Affiliation	Grants
		Airway Disease
		1999-2005, $8,716,000 – Southern California Particle Center and Supersite
		2000-2005, (Funded by the Health Effects Institute) – Effects of Prolonged Ozone Inhalation on Rats (five specific studies)
Suh, Helen	University of Chicago (IL)	2005-2010, $3,215,000 - Harvard Particle Center
		2003-2006, $934,000 - Chronic Exposure to Particulate Matter and Cardiopulmonary Disease
		1999-2005, $7,747,000 - EPA Harvard Center for Ambient Particle Health Effects
Weathers, Kathleen	Cary Institute of Ecosystem Studies (NY)	None
Wyzga, Ronald	Electric Power Research Institute	None

Science Advisory Board		
Allen, David T. (Chair)	University of Texas (TX)	2012-2015, $500,000 - Analysis of Dynamic, Flexible NO_x and SO_2 Abatement from Power Plants in the Eastern U.S. and Texas 2012-2015, $750,000 - Response of Regional Air Quality to Severe Drought 2005-2008, $969,000 - Texas Joint Center for Air Quality 2005-2007, $350,000 - Benchmarking Sustainability Engineering Education 2004-2007, $650,000 - Predicting the Relative Impacts of Urban Development Policies and On-Road Vehicle Technologies on Air Quality in the United States: Modeling and Analysis of a Case Study in Austin, Texas 2004-2005, $10,000 - Systems Approach to Recovery and Reuse of Organic Material Flows in Santa Barbara County to Extract Maximum Value and Eliminate Waste 2003-2006, $750,000 - Impacts of Climate Change and Land Cover Change on Biogenic Volatile Organic Compounds (BVOCs) Emissions in Texas 2000-2003, $325,000 - Development of Life Cycle Inventory Modules for Semiconductor Processing 2000-2004 (Funded by the Gulf Coast Hazardous Substance Research Center) - Engineering of Nanocrystal Based Catalytic Materials for Hydroprocessing of Halogenated Organics 2000-2004 (Funded by the Gulf Coast Hazardous Substance Research Center) - Catalytic Hydroprocessing of Chlorinated Wastes 1997-2000 (Funded by the Gulf Coast Hazardous Substance Research Center) - Catalytic Hydroprocessing of Chlorinated Organics
Alexeeff, George	California Environmental Protection Agency (CA)	None
Alvarez, Pedro J.	Rice University (TX)	2009-2011, $400,000 - Interactions of Natural Organic Matter with C60 Fullerene and their Impact on C60 Transport, Bioavailability and Toxicity 2008-2011, $400,000 - Effects of Quantum Dot on Microbial Communities 2006-2009, $400,000 - The Effect of Surface Coatings on the Environmental and Microbial Fate of Nanoiron and Feoxide Nanoparticles 2005-2008, $375,000 - Microbial Impacts of Engineered Nanoparticles 2000-2002, $195,000 - Effect of the Gasoline Oxygenate Ethanol on the Migration and Natural Attenuation of BTEX Compounds in Contaminated Aquifers 1995-1998, $246,000 - Biostimulation of BTX Degradation with Environmentally Benign Aromatic Substrates 1993-2000 (Funded by the Great Plains/Rocky Mountain Hazardous Substances Research Center) – The Role of Metallic Iron in the

		Biotransformation of Chlorinated Xenobiotics
Arvai, Joseph	University of Calgary (Canada)	1999-2001, $228,000 - Understanding Observed Differences in Time-Preference Rates
Burbacher, Thomas	University of Washington	2000-2005 (Funded by the Health Effects Institute) - Effects of Prenatal Exposure to Inhaled Methanol on Nonhuman Primates and Their Infant Offspring
Benitez-Nelson, Claudia	University of South Carolina (SC)	1996-1998, $102,000 - Phosphorus Cycling in the Gulf of Maine: A Multitracer Approach
Burke, Ingrid C.	University of Wyoming (WY)	1996-1999, $1,590,000 - A Regional Assessment of Land Use Effects on Ecosystem Structure and Function in the Central Grasslands
Burke, Thomas A.	Johns Hopkins University (MD)	2008-2011, $500,000 - Longitudinal Indicators of Policy Impact on Pollution, Exposure and Health Risk
Carney, Edward T.	The Dow Chemical Company	None
Daniel, Terry	University of Arizona (AZ)	None
Daston, George	Procter and Gamble (OH)	None
Denson, Costel	Costech Technologies, LLC (DE)	None
Doering III, Otto C.	Purdue University (IN)	1996-1999, $1,394,000 - Integrated Assessment of Economic Adaptation Strategies for Climate Change Impacts on Midwestern Agriculture
Dourson, Michael	Toxicology Excellence for Risk Assessment (OH)	None
Ducoste, Joel	North Carolina State University	2009-2012, $570,000 - An Integrated Approach to Understanding and Reducing Fat, Oil, and Grease (FOG) Deposit Formation for Sustainable Sewer Collection Systems
Dzombak, David A.	Carnegie Mellon University (PA)	1998-2001, $610,000 – Evaluation of Natural Amelioration of Acidic Deep Mine Discharges for Watershed Restoration
		1997-1999, $499,000 - Bioavailability and Biostabilization of PCBs in Soil
Eighmy, T. Taylor	Texas Tech University (TX)	None
Faustman, Elaine	University of Washington (WA)	2009-2015, $5,417,000 (Funded jointly with the National Institutes of Health) - Center for Child Environmental Health Risks Research
		2005-2008, $750,000 - Integrating Innovative Biomarkers of Environmentally Induced Disease for Children in Agricultural Communities
		2003-2008, $3,652,000 - Center for Child Environmental Health Risks Research
		1998-2003, $3,545,000 - Center for Child Environmental Health Risks Research
		1996-1999, $391,000 – Improving Methods for Identifying Noncancer Risks Application of Cell Kinetic Models for Methylmercury Risk Assessment
Field, R. William	University of Iowa	2009-20013, $899,000 - Applying Data Assimilation and Adjoint Sensitivity to Epidemiological and Policy Studies of Airborne Particulate Matter

Frey, H. Christopher	North Carolina State University	2010-1013, $500,000 - Framework for Context-Sensitive Spatially- and Temporally-Resolved Onroad Mobile Source Emission Inventories
		2008-2012, $893,000 - Spatial temporal analysis of health effects associated with sources and speciation of fine PM
		2004-2009, $680,000 - Advanced Modeling System for Forecasting Regional Development, Travel Behavior, and Spatial Pattern of Emissions
		1998-2001, $553,000 - Development and Demonstration of a Methodology for Characterizing and Managing Uncertainties in Emission Inventories
		1998-2001, $329,000 - Probabilistic Modeling of Variability and Uncertainty in Urban Air Toxics Emissions
		1998-1999, $180,000 - New Methods for Assessment of Pollution Prevention Technologies
Giesy, John P.	University of Saskatchewan (Canada)	2004-2007, $750,000 - Chemical Induced Changes in Gene Expression Patterns Along the HPG-axis at Different Organizational Levels Using a Small Animal Model (Japanese medaka)
		1996-1998, $305,000 - Development of a Bioassay for AhR-mediated Toxicity to Rainbow Trout
Harris, Cynthia M.	Florida A & M University	None
Johnston, Robert J.	Clark University	2007-2008, $199,000 - Meta-Analysis and Benefit Transfer at Different Levels of Aggregation: Comparing Group-Averaged and Individual-Level Models Using Hierarchical Bayesian Methods
		2005-2008, $405,000 - Improved Valuation of Ecological Benefits Associated with Aquatic Living Resources: Development and Testing of Indicator-Based Stated Preference Valuation and Transfer
Jones, Kimberly L.	Howard University (DC)	Final report dated 2000, project years unspecified (Funded by the Great Lakes/Mid Atlantic Hazardous Substance Research Center) - Membranes for the Separation, Recovery, and Reuse of Surfactant/Contaminant Solutions
Kahn, Bernd	Georgia Institute of Technology (GA)	None
Karr, Catherine	University of Washington	1999-2004 (Funded by the Research Center for Particulate Air Pollution and Health) - Epidemiologic Study of Particulate Matter and Cardiopulmonary Mortality
Khanna, Madhu	University of Illinois at Urbana-Champaign (IL)	2003-2006, $252,000 - Oregon Business Decisions for Environmental Performance
		2003-2006, $287,000 - Pollution Prevention: The Role of Environmental Management and Information
		1999-2001, $242,000 - Business-led Environmental Management: Economic Incentives and Environmental Implications
Kim, Nancy K.	Health Research, Inc. (NY)	None
Laden, Francine	Harvard University and Brigham and Women's Hospital	2003-2006, $934,000 - Chronic Exposure to Particulate Matter and Cardiopulmonary Disease
		1999-2005, $7,747,000 - EPA Harvard Center for Ambient Particle Health Effects
Lue-Hing, Cecil	Cecil Lue-Hing & Assoc. Inc. (IL)	None

Matsui, Elizabeth	Johns Hopkins University	2009-2014, $4,250,000 - Johns Hopkins Center for Mechanisms of Asthma-Dietary Interventions against Environmental Triggers 2003-2008, $4,046,000 - Johns Hopkins Center for Childhood Asthma in the Urban Environment
Menon, Surabi	ClimateWorks Foundation	None
Mihelcic, James R.	University of South Florida (FL)	2004-2005, $10,000 - P3 Design Project for an Interdisciplinary Team of Graduate Students: Development of Appropriate, Sustainable Construction Materials 1997-1999 (Funded by the National Center for Clean Industrial and Treatment Technologies) - Development of Environmental Indices for Green Chemical Production and Use
Moe, Christine	Emory University (GA)	2009-2012, $600,000 - Measures of Distribution System Water Quality and Their Relation to Health Outcomes in Atlanta 2004-2007, $590,000 - Examining Epidemiologic and Environmental Factors Associated with Microbial Risks from Drinking Water 2004-2007, $1,223,000 - Drinking Water Quality and Emergency Visits for Gastroenteritis in Atlanta 2002-2005, $1,821,000 - A Prospective Epidemiological Study of Gastrointestinal Health Effects Associated with Consumption of Conventionally Treated Groundwater 1998-2001, $588,000 - Studies of the Infectivity of Norwalk and Norwalk-like Viruses
Moo-Young, Horace	California State University (CA)	None
Murphy, Eileen	Rutgers University (NJ)	None
Opaluch, James	University of Rhode Island (RI)	1998-2001, $325,000 - Environmental Policy and Endogenous Technical Change: A Theoretical & Empirical Analysis 1995-1997, $126,000 - Developing Conjoint Stated Preference Methods for Valuation of Environmental Resources Within Their Ecological Context
Patten, Duncan	Montana State University (MT)	2005-2007, $293,000 - Land Use Land Cover Change Governing Watershed Nitrogen Threshold and Stream Water Quality 1999-2002, $868,000 - Developing Effective Ecological Indicators for Watershed Analysis
Philbert, Martin	University of Michigan	1998-2003, $2,831,000 - Michigan Center for the Environment and Children's Health
Polasky, Stephen	University of Minnesota (MN)	1998-2001, $810,000 - Developing Methods and Tools for Watershed Restoration: Design, Implementation, and Assessment in the Willamette Basin, Oregon 1998-2000, $131,000 - Land and Management with Biological and Economic Objectives 1997-1999, $1,229,000 - Modeling Effects of Alternative Landscape Design and Management on Water Quality and Biodiversity in Midwest Agricultural Watersheds 1996-1998, $271,000 - Decision-Making under Uncertainty in the Conservation of Biological Diversity
Pope, III, C. Arden	Brigham Young University (UT)	2011-2013, $300,000 - The Effect of Air Pollution Control on Life Expectancy in the United States

		2011-2014, $299,000 – Associations of Short-Term Pollution Exposures with Childhood Autoimmune Disease
		2000-2003, $797,000 – Relationship between PM2.5 Semi-volatile Organic Material, Other PM2.5 Components, and Heart Rate Variability in the Elderly
		2000-2005 (Funded by the Health Effects Institute) - Daily Changes in Oxygen Saturation and Pulse Rate Associated with Particular Air Pollution and Barometric Pressure
Roberts, Stephen M.	University of Florida (FL)	None
Rodewald, Amanda	The Ohio State University (OH)	None
Sanders, James	Skidaway Institute of Oceanography (GA)	None
Schlesinger, William	Cary Institute of Ecosystem Studies	None
Solomon, Gina	Natural Resources Defense Council (CA)	None
Stram, Daniel O.	University of Southern California (CA)	2005-2010, $8,000,000 - Southern California Particle Center
		1999-2005, $8,716,000 - Southern California Particle Center and Supersite
Thorne, Peter S.	University of Iowa (IA)	2004-2007, $335,000 - Impacts of Manufactured Nanomaterials on Human Health and the Environment - A Focus on Nanoparticulate Aerosol and Atmospherically Processed Nanoparticulate Aerosol
		1995-1998, $635,000 - Indoor Air Quality in Large Office Buildings in the Midwest
Tolbert, Paige	Emory University (GA)	2010-2015, $8,000,000 - The Southeastern Center for Air Pollution and Epidemiology: Multiscale Measurements and Modeling of Mixtures
		2009-2012, $599,000 - Measures of Distribution System Water Quality and Their Relation to Health Outcomes in Atlanta
		2008-2012, $900,000 - Improving Particulate Matter Source Apportionment for Health Studies: A Trained Receptor Modeling Approach with Sensitivity, Uncertainty and Spatial Analyses
		2007-2010, $500,000 - Development and Assessment of Environmental Indicators: Application to Mobile Source Impacts on Emissions, Air Quality and Health Outcomes
		2004-2007, $1,223,000 - Drinking Water Quality and Emergency Visits for Gastroenteritis in Atlanta
		2002-2004, $1,239,000 - Multiple Pollutants and Risk of Emergency Department Visits for Cardiorespiratory Outcomes in Atlanta
		1996-1999, $360,000 - The Michigan PBB Cohort 20 Years: Endocrine Disruption?
VanBriesen, Jeanne	Carnegie Mellon University	None
Vena, John	University of Georgia (GA)	2002-2004, $325,000 - Material Selection in Green Design and Environmental Cost Analysis
Zoeller, R. Thomas	University of Massachusetts (MA)	2004-2008, $739,000 - Low-Dose Effects of Thyroid Toxicants on Neurodevelopment

Source: Membership lists are from EPA websites at: "Members of the Advisory Council on Clean Air Compliance Analysis," http://yosemite.epa.gov/sab/sabpeople.nsf/WebExternalCommitteeRosters?OpenView&committee=COUNCIL&secondname=Advisory%20Council%20on%20Clean%20Air%20Compliance%20Analysis%20; "Board of Scientific Counselors, Executive Committee," http://www.epa.gov/osp/bosc/exec-comm.htm; "Members of the Clean Air Scientific Advisory Committee," http://yosemite.epa.gov/sab/sabpeople.nsf/WebExternalCommitteeRosters?OpenView&committee=CASAC&secondname=Clean%20Air%20Scientific%20Advisory%20Committee); "Members of the Science Advisory Board," (http://yosemite.epa.gov/sab/sabpeople.nsf/WebExternalCommitteeRosters?OpenView&committee=BOARD&secondname=Science%20Advisory%20Board); and "Scientific Advisory Panel, Members," http://www.epa.gov/scipoly/sap/members.htm. Grants are from the EPA National Center for Environmental Research (NCER) Project Database at (http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/search.welcome).

Notes: Grants are for projects identified for which the person in question is either a principal investigator or a co-investigator. Grants generally are assigned to the academic institution where the member is employed, and only a very small proportion, if any, of the grant may be paid in the form of salary to the member. In some cases, grants are for major national research centers that house numerous research projects and potentially involve dozens of students and post-doctoral fellows and several professors at several institutions. In some cases, grants are for major national research centers that house numerous research projects and potentially involve dozens of students and post-doctoral fellows and several professors. Funding for specific projects supported by these centers is not specified in the NCER database and not reported in Table 1. Similarly, some research grants were for projects that are funded through the public-private Health Effects Institute or university consortia known as Hazardous Substance Research Centers. The latter centers were established under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) section 311(d) and are jointly funded by EPA and the National Institute for Environmental Health Sciences. NCER does not provide funding information for these projects, and Table 1 does not include such information. Grant amounts are rounded to the nearest $1,000. Project funding amounts also may be listed more than once, because more than one committee member may receive funding from the same grant. In addition, some grants are provided by multiple agencies, and the multi-agency total for the project may be stated in the database, although only a portion of the funding derives from EPA's budget. For this reason it would be inappropriate to sum the grant amounts to obtain a total EPA funding amount across committee members or any single committee member.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

November 8, 2013

Chairman Lamar Smith
Committee on Science, Space and Technology
2321 Rayburn House Office Building
Washington, DC 20515

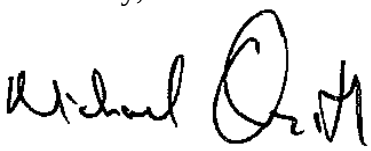
Dear Chairman Smith,

The following statement is based on review of the files your staff submitted to me on August 19th, September 13th and September 30th. The file names are listed in attachment 1.

The subpoena sent by the Committee on Science, Space and Technology to EPA Administrator Gina McCarthy dated August 1, 2031 requested "all analysis and re-analysis of" the Cancer Prevention Study II by the American Cancer Society (ACS) and the Harvard Six Cities (HSC) Studies. The files supplied to date do not fulfill this request. The ACS files do not contain sufficient information on mortality or other variables (age, air conditioning, alcohol use, body mass index, diet, education, employment, income, marital status, race, sex, smoking, and workplace exposure– all included variables in the Pope *et al*. 2002 study as well as the reanalysis by Krewski *et al.* in 2009). The HSC files contain coded data on mortality incidence and air quality, but no information on other variables (age, body mass index, education, race, sex, and smoking – all included variables in the Laden *et al.* 2006 study as well as the reanalysis by Lepeule *et al.* 2012). Furthermore, there is no information regarding the analysis of this data, including critical assumptions or choice of inputs, as would be required for the statistical tests applied (e.g. for Pope *et al.* 2002: Cox proportional hazards modeling with spatial autocorrelation and nonparametric spatial smoothing; for Krewski *et al.* 2009 the Land Use Regression results for industrial, residential, commercial, and agricultural categories are missing; and for Lepeule *et al*. 2012: the "rstrata" variable apparently codes for sex, age, and time period, but the codes are not defined).

In conclusion, the files provided to date lack critical information, making it impossible to replicate the findings of the ACS or HSC studies.

Sincerely,



Michael Honeycutt, Ph.D.
Director, Toxicology Division
Texas Commission on Environmental Quality

Attachment 1

Files Sent by Committee Staff and Reviewed by TCEQ

Sent August 19, 2013:
Copy of Pope etal 2009 NEJM analytic data and dictionary.xls
EPA Response 8-19-2013.pdf

Sent September 13, 2013:
09-13-2013 EPA Response.pdf
acszipec80.sas7bdat
airp_al.sas7bdat
houseincome.sas7bdat
IPm.dat
ipm_mas.ssd01
Krewski 2009 Data Set Descriptions.doc
lazips270.sas7bdat
ny_krige_lur.xls
o3new.sas7bdat
pm_7200.sas.7bdat
pm25_29.sas7bdat
smsa_gas.ssd01
so2_all.sas7bdat
tsp_8081.ssd01
zip267pm25lur.sas7bdat

Sent September 30, 2013:
Lepeule2012_data_0713 Final.xlsx
Lepeule2012_data_0713_datadictionary final.docx

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CONGRESSIONAL AND
INTERGOVERNMENTAL RELATIONS

OCT 30 2013

The Honorable Lamar Smith
Chairman
Committee on Science, Space and Technology
U.S. House of Representatives
Washington, D.C. 20515-6301

Dear Mr. Chairman:

I am writing today to follow up on the commitments we made in our letter of July 30, 2013, to keep you apprised of certain information related to your interest in research data from certain epidemiological studies.

Enclosed, please find: a letter from Harvard University, dated September 25, 2013; a letter from Brigham Young University, dated August 1, 2013; a letter from the American Cancer Society, dated August 19, 2013; a letter from the Health Effects Institute, dated August 27, 2013; and, a letter from the Harvard School of Public Health, dated September 6, 2013.

Please feel free to contact me if you have any questions, or your staff may contact Tom Dickerson in my office at dickerson.tom@epa.gov or (202) 564-3638.

Sincerely,

Laura Vaught
Associate Administrator

Enclosures

cc: The Honorable Eddie Bernice Johnson
Ranking Member

OCT 3 0 2013

HARVARD UNIVERSITY
Office for Sponsored Programs

Catherine Breen
Senior Director, Office for Sponsored Programs
catherine_breen@harvard.edu

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September 25, 2013

BY FEDERAL EXPRESS

Mr. Lek Kadeli
Principal Deputy Assistant Administrator
Office of Research and Development
U.S. Environmental Protection Agency
Room 41209
1300 Pennsylvania Ave NW
Washington, DC 20004

Dear Mr. Kadeli:

I am writing on behalf of Harvard University in response to the letter that you sent to Professor Francine Laden on July 8, 2013. Your letter transmitted a request that your agency had received from Senator David Vitter relating to several epidemiological studies on the health effects of certain kinds of air pollution, including a 2006 article written by Prof. Laden and other Harvard researchers ("Reduction in Fine Particulate Air Pollution and Mortality." *American Journal of Respiratory and Critical Care Medicine*. 173: 667-672). According to your letter, the EPA has committed to engaging with Prof. Laden and other researchers to understand what information may be available in response to the Senator's request.

As an institution of higher education focused on teaching, research and scholarship, Harvard believes in and advocates for the exchange of data to advance scientific knowledge. At the same time, we have a responsibility to protect not only individual privacy but also our researchers' intellectual property – interests explicitly recognized in both the Freedom of Information Act and the Shelby Amendment. See 5 U.S.C. § 552(b)(4) and (6); 5 U.S.C. § 552(b)(6).2 C.F.R. § 215.36(d)(2)(i).

Large long-term epidemiological studies, like the air pollution research in question, rely on the participation of thousands of human participants. Without assurances that their private medical and other identifying information will be protected, people would not agree to be part of such studies. In this case, Harvard researchers promised to ensure confidentiality not just to the participants themselves, but also to federal and state agencies.

Moreover, for science to flourish, we must recognize and protect researchers' thought processes, innovative ideas, unique approaches and research designs. Under the Shelby Amendment, for example, research data is defined as "the recorded factual material commonly accepted in the scientific community as necessary to validate research findings;" it does not include "preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, or communications with colleagues." 2 C.F.R. § 215.36(d)(2)(i). Likewise, programs and software that researchers have written are not considered research data.

Your letter recognizes that, in March 2012, after receiving a request pursuant to the Shelby Amendment, Harvard provided to the EPA research data relating to the 2006 article cited by Senator Vitter, and further notes that the EPA subsequently gave a copy of what was provided to Senator Vitter. As required by our confidentiality obligations, this data set did not include individually identifiable information about study participants, nor would Harvard provide such information now.

Moreover, the Krewski report cited in Senator Vitter's request (Krewski, Burnett, et al., 2000. "Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality, Special Report to the Health Effects Institute") (the "HEI Report") itself contains a comprehensive description of the data collection procedures and an audit of the original data from the Harvard Six Cities study, which was the basis for Prof. Laden's 2006 reanalysis. *See generally* HEI Report Part 1: Replication and Validation at 41-130. For example, the HEI Report specifically describes efforts to review original study protocols (at 42 and 94), describes the data processing and quality control (at 42–64), and provides a detailed review of the death certificate coding protocols (at 47-49). A copy of the questionnaire used in the Harvard Six Cities study is reprinted (at 99-114), along with the questionnaire code book (at 115-16). Thus, Senator Vitter already has access to much of the information he is now requesting.

It is also worth noting that a great deal of time has elapsed since data collection began in these long-term air pollution studies. Existing electronic data from the early years of the Harvard Six Cities study may have deteriorated, or may be stored on media that cannot now be read or deciphered by any available devices or software.

I hope this information is helpful to you. If you have any questions or comments, please do not hesitate to contact me.

Sincerely,

Catherine Breen

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August 1, 2013

Lek Kadeli
Principal Deputy Assistant Administrator
Office of Research and Development
United States Environmental Protection Agency
Washington, D. C. 20460

RE: Requests for data, protocols, methods and related information pertaining to specific epidemiology studies of air pollution and human health.

Dear Lek Kadeli:

I am writing regarding the requests for data, protocols, methods and related information pertaining to specific epidemiology studies on the health effects of particulate matter and ozone air pollution of which I have served as a principle or co-investigator. Details of this request are discussed in your letter dated July 8, 2013 to me and are detailed in the request from Senator Vitter's staff listing the studies and materials requested.

Harvard Six-Cities Cohort Study: Although I was a co-investigator on the initial study of long-term exposure to air pollution and mortality risk (Dockery et al. 1993[1]), data analysis was conducted on site while at Harvard. I have not been a co-investigator on the extended follow-up studies of the Harvard Six-Cities cohort (including Laden et al. 2006[2], Schwartz et al. 2008[3], Lepeule et al. 2012[4]) and I do not currently have copies of or direct access to this study's data files. I note, however, that the Kreski et al. 2000 Health Effects Institute (HEI) reanalysis report[5] and its appendices provide documentation of the Harvard Six-Cities Cohort study that includes an independent data audit, replication of the results of the initial study, copies of the questionnaires and codebook, computer programs and output used in the replication of the original analysis, and related information. The extended follow up studies of the Harvard Six-Cities studies[2-4] provide even further important documentation, replication, and important extensions of the Harvard Six-Cities cohort study.

American Cancer Society Cohort study: The American Cancer Society Cancer Prevention Study II (ACS CPS-II) cohort data were collected by the ACS. The original ACS CPS-II cohort study of long-term exposure to air pollution and mortality (Pope et al. 1995[6]) was a collaborative research effort with ACS researchers. Data analyses occurred on site at the ACS in Atlanta. As

part of the extensive HEI sponsored re-analyses, the ACS made data sharing agreements that allowed separate data access by a large, independent reanalysis team headed by Dr. Dan Krewski at the University of Ottawa to conduct data auditing, replication of originally published results, and substantial sensitivity analyses. For complete documentation, see Krewski et al. 2000.[6] After the re-analysis report was published in 2000, I collaborated on various research projects with researchers from ACS, University of Ottawa, UC Berkeley and elsewhere that was designed to further extend and document the analysis of the original ACS cohort study and the ACS re-analysis. The ACS CPS-II cohort data used in these studies have remained under the ownership of the ACS. Data analyses has been conducted consistent with maintaining the privacy and confidentiality of research participants and data sharing agreements with ASC. As an external co-investigator collaborating with the ACS, I am not authorized nor am I able to provide any ACS CPS-II cohort data files.

With regards to requests for study protocols, statistical methodologies, questionnaires, and related information pertaining to our studies of air pollution and mortality using the ASC CPS-II cohort, we have and continue to provide substantial documentation in various published and peer-reviewed papers and research reports. Most of the publications are journal articles (including Pope et al. 2002[7], Pope et al. 2004[8], Jerrett et al. 2005[9], Jerrett et al. 2009[10], Turner et al. 2011[11], Jerrett et al. 2013[12]) that are necessarily brief (but sometimes include additional documentation in the form of electronic appendices). Others are published as relatively large reports (Krewski et al. 2000[6], Krewski et al. 2009[13], Jerrett et al. 2011[14]) with even more extensive documentation. Various statistical and other methodological approaches developed for and/or used in these analyses have generally been publically documented in multiple publications and are cited in the journal articles and research reports. Copies of the questionnaires and codebook used in the ACS study are published in the Krewski et al. 2000 HEI report[6]. Available on request to the HEI are appendices that include information regarding computer programs and output used in the replication of the original analysis, the quality assurance audit of the data, occupational exposures, flexible modeling of effects of fine particles and sulfate on mortality, alternate air pollution data, selection of ecologic covariates, definition of metro areas, values of the ecologic covariates, spatial analyses, and random effects Cox models. The questionnaires and other documentation for the ACS cohort are also publically available directly on line. (For a general documentation of the American Cancer Society Cancer Prevention Study II see: http://www.cancer.org/research/researchtopreventcancer/currentcancerpreventionstudies/cancer-prevention-study
For the study questionnaires see:
http://www.cancer.org/research/researchtopreventcancer/cancer-prevention-questionnaires).

U.S. Life Expectancy study: The study of reduction in fine particulate air pollution and life expectancy in the U.S. (Pope et al. 2009[15]) utilizes data from public sources. The life expectancy data were generated using publically available data as documented in a published paper (Ezzati et al. 2008[16]) and the complete data set for the generated life expectancy data is directly available on line at
http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.0050066#s5 .
The socio-demographic and other variables used in the analysis are also directly available from public sources clearly referenced in the paper. For those who do not want to reconstruct the data from original publicly available data sources, we have also provided an analytic data file (in

Excel Spread Sheet format and with a complete data dictionary) that includes the full data for the 211 counties in the analysis, that can and has been used to reproduce the paper's results using standard statistical software. These data have been provided under separate cover from Harvard University. Additional published papers have provided extended discussion of methodology and protocol (Pope et al. 2012[17]), provided sensitivity analysis regarding potentially influential observations and statistical outliers (Krstic 2012[18], Pope et al. 2013[19]) and have provided some expanded and extended analysis (Correia et al. 2013[20]).

I appreciate the importance of continued efforts to more fully understand the effects of air pollution on human health. I am also fully supportive of open, collaborative, efforts to use data and information in such a way that truly contributes to our scientific understanding, that does not violate the privacy and confidentiality of research participants, that maintains the integrity of the data, and that respects responsible and appropriate sharing of data and replication of results.

Sincerely,

C. Arden Pope III, PhD
Mary Lou Fulton Professor of Economics
Brigham Young University

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Otis W. Brawley, MD, FACP
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American Cancer Society

August 19, 2013

Lek Kadeli
Principal Deputy Assistant Administrator
Office of Research and Development
Environmental Protection Agency
Washington, DC 20460
VIA E-MAIL

Dear Mr. Kadeli:

Thank you for your letter of July 8, inquiring about the permissibility of sharing research data used in certain epidemiological studies focusing on the health effects of particulate matter and ozone pollution. The following is the American Cancer Society's (the Society's) response to your questions.

For 100 years, the Society has worked tirelessly to save lives and create a world without cancer. Along with millions of supporters—over one million of whom volunteered to participate in our research studies—we have committed ourselves to eliminate cancer as a major public health problem. We have been able to lead the way in cancer research by building a foundation of trust with the public and by always placing the public good at the forefront of our mission.

Your inquiry appears to focus on Cancer Prevention Study II (CPS-II) data that were used in four of the studies listed in your letter: Krewski et al (2000),[1] Pope et al (2002),[2] Jerrett et al (2009),[3] and Krewski et al (2009).[4] CPS-II data were not used in the other studies you identified.

What Is CPS-II and Why Are the Data So Valuable?

The Society established CPS-II in 1982. Over the last 31 years, through the recruitment of nearly 1.2 million male and female participants by approximately 77,000 volunteers in 50 states, the District of Columbia and Puerto Rico, the Society has amassed this data set as a powerful tool to identify the risk factors for cancer and, ultimately, learn how to prevent it. CPS-II data contain comprehensive demographic information as well as health, personal habit history, and economic information. Mortality follow-up of the entire CPS-II cohort continues today with biennial linkage to the National Death Index. The Society has also followed up with subgroups of the larger cohort in a variety of ways, including through repeat questionnaires for assessing cancer incidence and other information and the collection of blood samples and buccal cells for genetic analysis. In addition, Society epidemiologists recently began the retrospective and

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prospective collection of breast, colorectal, hematopoietic and prostate cancer tumor specimens. In short, the CPS-II data set is one the most comprehensive longitudinal data sets in existence.

CPS-II data and corresponding follow-up studies using the data have played a major role in cancer prevention both nationally and internationally over the past several decades. More than 500 scientific articles have been published and the findings have significantly contributed to our understanding of the health effects of tobacco use, obesity, diet, physical activity, hormone use, and various other exposures in relation to cancer and other diseases.

The value to science and the public of the CPS-II data is incalculable. It is a very large snapshot of human information as it existed and evolved over a period of time, and it continues to be extremely relevant to scientific inquiry. It is a medical treasure built with the commitment of our donors, volunteers, staff, and, most importantly, CPS-II participants.

Responses to EPA's Specific Questions

1. Who owns and/or holds the data necessary to replicate the relevant studies and what are the concerns, if any, associated with making such data publicly available?

A. Control of data

The Society owns, holds and is entrusted with the stewardship of the individual-level CPS-II data. The Society funded and oversaw the collection of the data, and now directs and controls their dissemination. We obtained some of the mortality data in the CPS-II data set from the Centers for Disease Control and Prevention, which manages the nation's National Death Index (NDI). As we explain below, the Society's use and subsequent disclosure of NDI data is limited to those uses and disclosures permitted under NDI's implementing regulations.

The CPS-II data have since been linked, using participant zip codes or other location information, to ecological information about the area in which the subjects lived (the "Linked Analyses"). These Linked Analyses are conducted by Dr. Daniel Krewski at the R. Samuel McLaughlin Centre for Population Health Risk Assessment at the University of Ottawa, under an agreement with the Society to ensure that he and the University handle our individual level data from CPS-II responsibly and ethically.

B. Concerns associated with publicizing data

The Society has a number of serious legal, ethical, and policy concerns regarding disclosure of both the individual level CPS-II data and the Linked Analyses. At the core of our concern is the Society's ethical obligation as steward of personal and highly confidential information. Accordingly, we follow prevailing privacy norms with respect to the data, and we made assurances to participants, the NIH, and the NDI. To provide identifiable data to Congress under these circumstances would violate these legal obligations and commitments. Moreover, the Society's decades-long investment of resources made the collection of CPS-II data possible, and today the data are priceless.

i. *The Society's duty to maintain confidentiality*

a) Certificate of Confidentiality and the National Death Index

The CPS-II data are protected by a Certificate of Confidentiality issued by the NIH to the Society. Under section 301(d) of the Public Health Service Act (42 U.S.C. 241(d)) the Secretary of Health and Human Services may authorize persons engaged in biomedical, behavioral, clinical, or other research to protect the privacy of individuals who are the subjects of that research. This authority has been delegated to the NIH. 42 U.S.C. 241(d). The statute prohibits involuntary disclosure of protected research data:

> Persons authorized by the NIH to protect the privacy of research subjects may not be compelled in any Federal, State, or local civil, criminal, administrative, legislative, or other proceedings to identify them by name or other identifying characteristic. 42 U.S.C. 241(d)

If the Society were forced to provide CPS-II data to Congress in direct violation of this statute, the Society would not only breach its Certificate of Confidentiality, but the entire concept of the Certificate and the protection it provides could be in doubt.

Moreover, under these circumstances the Society could not release the information it has received about CPS-II participants' cause of death from the National Death Index, a necessary component of the data to reanalyze the studies in question. The NDI regulations include protections against releasing identifiable information. As we describe in response to Question #2, we are not aware of any way to create a de-identified version of the CPS-II data set sufficient to protect the confidentiality of the participants while at the same time allowing a true replica of the studies.

b) Privacy Policies

The Society is sensitive to and understands the important role of Congress in oversight of environmental policy, but we are concerned that the House of Representatives Committee on Science, Space and Technology's authorization to issue a subpoena for our CPS-II data may put the Society in a position that is inconsistent with prevailing privacy and security standards. Since at least the mid-20th century, confidentiality has been a central tenet of ethical protections for research participants. Individuals share confidential information about themselves to make biomedical and public health research possible and, in exchange, researchers and the public at large assure these volunteers that their confidential data will only be used and disclosed in certain, limited ways. In recent years, these privacy and security protections have become enshrined in various forms, for example in the Health Insurance and Portability and Accountability Act and its implementing regulations, confidentiality protections set forth in the National Death Index regulations, state law, and "privacy by design" principles set forth by the Federal Trade Commission. Although these privacy and security frameworks differ in some respects, core commonalities persist, suggesting a converging set of expectations pertaining to privacy and security.

For example, prevailing privacy norms recognize the need for individuals to be informed about possible permissible uses and disclosures of their data. A closer look at HIPAA is instructive as to legal and public expectations as to privacy. The central tenet of HIPAA is that all uses and disclosures of identifiable data are prohibited, unless they are expressly permitted. Permitted disclosures include those made pursuant to carefully worded authorizations, to *bona fide* researchers under certain, controlled and monitored circumstances, and for public health purposes to health care oversight agencies. HIPAA does not contain any exception to these principles for general congressional curiosity.

Although the Society itself is not directly regulated by HIPAA, most research institutions, such as hospitals and academic medical centers, must comply. The Society is committed to extending the same privacy protections to its research participants as the law would empower institutional providers to extend to their research participants. CPS-II participants deserve no less.

c) Protocols for maintaining confidentiality

Every voluntary participant was assured that their identity and the information they provided, often of a very personal nature, would be kept confidential and used only in connection with research. Volunteers who participated in CPS-II were motivated by a desire to help the fight against cancer and were assured that their commitment and generosity of time and candor would be protected. The confidentiality protections that the Society has in place are vital to the success of research participant recruitment efforts. To balance our promise to the CPS-II participants with our commitment to scientific inquiry, we have a rigorous process to allow outside investigators to request access to CPS-II data subject to confidentiality protections, as explained in our answer to Question #3 below.

ii. *Negative effect on future research*

Violating our legal obligations and breaking the promises we made to participants could damage not only the Society's reputation, but also the next phases of our scientific and public health work. For example, we are currently recruiting participants for our third cancer prevention study ("CPS-3"), and we are concerned that even the threat that Congress might appropriate and possibly make participants' information publicly available could negatively impact our recruitment efforts. More importantly, if research participants believe that confidentiality protections might be limited in circumstances such as these, individuals' willingness to participate in research in all areas may be eroded.

The rationale for the Federal government's acquisition of the CPS-II data appears to be that these underlying data were used in studies that the EPA cited to justify regulatory action. But this sets a dangerous precedent for scientific research: organizations will have reason to fear that any research data cited in connection with a government rulemaking might be subject to confiscation and distribution to the public. This kind of precedent could create a disincentive to researchers to share data, especially if there is a connection to a government rulemaking. Moreover, research entities might limit their own work, choosing to conduct only research that would not be used for government rulemaking to ensure their underlying data are protected. The result could be a breakdown in the collaborative process between scientists necessary to scientific advancement and an impediment to scientific inquiry, particularly in areas of interest for the government. In

addition, this introduces a fundamental disparity in the ethical protections and safeguards for participants in research depending on whether the research is used to inform government policy. What a tragic and ironic disincentive it would be to inform the public that when they give of themselves to support research identified as being of national importance, they must sacrifice basic confidentiality protections.

iii. *Congress cannot properly order EPA to 'take' this data*

The Society's individual level CPS-II data at issue here were funded and collected by the American Cancer Society, and, to the best of our knowledge, without the use of Federal funds. As it is a longitudinal, nationwide study dating from 1982, it is unique and not replicable, and its value cannot be measured. If we were forced by a Committee of the U.S. Congress or by any agency of the executive branch of the federal government to make public this privately created and privately funded resource, it could be akin to taking our property without just compensation in violation of the Fifth Amendment.

iv. *Uncertainty about dissemination caused by Congress is a concern*

Our concerns about confidentiality, the adverse effect on research, and the acquisition of our private property are compounded by statements made about how Congress might disseminate our participants' information. It is our understanding that the House of Representatives Committee on Science, Space and Technology has authorized the Committee Chairman to acquire the CPS-II data by subpoena, if necessary, with the intention of making the data set available "*on the Internet*," as the Chairman stated in an August 1, 2013 public hearing on the subject. The idea that Congress would publish our participants' information online only magnifies our concerns.

2. **What are the technical options for making these data publicly available, taking into account any concerns about the release of confidential personal health information or other confidential data? What are the implications of these options for replicating these studies? What level of effort in terms of time and resources would be required for these options?**

In order to accurately replicate the studies, Congress will need data and statistical programs that the Society does not hold or control in addition to the raw data in CPS-II. First, Congress will need access to the National Death Index to link the CPS-II data to death records, and to do that, Congress would need the Society to provide participants' name, social security number, date of birth, and state of residence. Then, Congress or others would have to link the appropriate ecological variables to our CPS-II data. Otherwise, Congress will need access to the Linked Analyses, which are maintained by Dr. Daniel Krewski at the University of Ottawa, under an agreement with the Society.

With respect to the Linked Analyses, we do not currently have the internal expertise to determine definitively whether it is possible to code or otherwise modify them in such a way as to protect the confidentiality of our CPS-II participants and also allow for true replication of the studies. To determine what might be possible, we would have to engage outside experts, at considerable expense. This is likely to be a time-consuming and long-term effort with uncertain resolution.

Regarding the CPS-II data, it appears impossible to create a public version that would protect the confidentiality of the CPS-II participants while at the same time allowing a true replica of the studies. To enable study replication, we would have to include individual level information, including participants' location, such as zip code or partial zip code, to enable others to link ecological information. The zip code or partial zip, along with updated zip codes for a portion of the participants, would be listed with a wide variety of personal information, including age, race, gender, education, marital status, height, weight, alcohol consumption, smoking history, exposure to environmental tobacco smoke, occupational history and exposures, and, if applicable, cause of death and death date. Using HIPAA as our guide, we note that zip code *alone* is, in some cases, considered an identifier. Accordingly, the residual zip code information, which is necessary to facilitate the linking with ecological data, combined with other information about each participant, such as race, ethnicity and other data points, would heighten the risk of re-identification. In fact, in light of explosion of publicly available data that can be used to re-identify individuals with data otherwise appearing to be de-identified, regulators continue to expand the single data fields that are classified as "identifiers." While the Society might be able, with sufficient time and resources, to remove all of the confidential or identifying information so that individual CPS-II participants could not be identified, such a data set would be so limited and generic that it would not enable a researcher to replicate the studies in question.

3. **If there are no feasible options for making all of the data publicly available, how would a researcher gain access to the full set of underlying data in order to replicate these studies? Please provide any documentation you believe would be helpful in understanding this process.**

The Society recognizes the value of externally-proposed studies that are of general interest and high scientific merit. We welcome outside investigators to request access to our data following our application process, the details of which are available on our website.[5] We only grant access to well-qualified researchers who have demonstrated that their proposed research is well-designed and has the potential to significantly contribute to scientific discourse, and who have the requisite knowledge, qualifications, and experience to conduct the analysis and protect our data.

Once a proposal is accepted, we take various measures to protect our data. Each researcher who is granted access to the data has restrictions on the use and publication of the data and must conduct the research consistent with applicable legal and ethical requirements. Further, a deep understanding of the history of CPS-II and the complexity of the database is needed to conduct scientifically valid research using CPS-II data. Therefore, we require external researchers to work collaboratively with Society investigators, including co-authorship on any resulting publications, and the researchers and their institutions must sign the Society's "Collaboration Agreement," which includes requirements designed to protect the confidentiality of the participants in the research. Moreover, we only give the investigator access to the data that are necessary to conduct the analysis.

The Society may choose to deny requests from individuals sponsored by interest groups who have demonstrated they are not interested in independent and objective scientific research. For example, we have on occasion refused to provide access to scientists who were publicly linked to

sponsorship by tobacco companies. These data are a public trust. We take that responsibility seriously.

We are currently engaged in more than 30 collaborations with outside investigators. With respect specifically to the CPS-II data used for the studies referenced in your letter, I am sure you are aware that the Krewski (2000) study was a replication of original studies precisely because some were concerned about the objectivity related to the results and conclusions of these original studies. As a result of those concerns, the Society shared the necessary data under a confidentiality agreement to ensure our data were properly protected and the reanalysis was done under the auspices of the Health Effects Institute and conducted by a neutral third party.

In summary, the Society has a number of concerns regarding the potential disclosure of our CPS-II data. To compile the CPS-II data set, we assured the 1.2 million individuals who provided personal information to help us understand what causes and prevents cancer that we would maintain the confidentiality of this information. We also applied for and were awarded a National Institutes of Health-issued Certificate of Confidentiality that protects the entire data set, from the date of its inception from disclosure. At the same time, we value the contributions that outside investigators can make using our CPS-II data, which is why we have a process to allow them to apply to access our data subject to confidentiality protocols. Producing CPS-II data to the Federal government outside of our standard process, when we can be given no assurances of how it will be used, by whom, and how widely it would be disseminated, would cause the Society to betray its own policies, the promises it made to participants, covenants with both the NIH and the National Death Index, and prevailing privacy norms. Moreover, the Society has invested countless resources to collect and analyze the CPS-II data, including three decades of work, tens of millions of dollars, and the dedication of 77,000 volunteers. Leaving aside the Society's critical concerns about confidentiality for the citizens who provided personal data, it would be improper for the Federal government to imply appropriate this privately created data set and make it publicly available.

The Society has engaged outside counsel to assist it in protecting the integrity of our CPS-II data. Please include Mr. Stephen M. Ryan of McDermott Will & Emery, LLP and the Society's General Counsel, Mr. Timothy B. Phillips, on all future correspondence. They are the only persons authorized to respond for the Society to any EPA need for further information.

Thank you for your careful consideration of the issues we have raised.

Sincerely,

Otis Brawley, MD, FACP
Chief Medical and Scientific Officer

[1] Krewski D, Burnett RT, Goldberg MS, Hoover K, Siemiatycki J, Jarret M, Abrahamowicz M, White WH. Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality. Special Report. Health Effects Institute, Cambridge MA, 2000.

[2] Pope CA III, Burnett RT, Thun MJ, Calle EE, Krewski D, Ito K, Thurston GD. Lung cancer, cardiopulmonary mortality and long-term exposure to fine particulate air pollution. *Journal of the American Medical Association* 2002;287:1132-1141.

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[5] http://www.cancer.org/acs/groups/content/@research/documents/document/aCPSc-039148.pdf

HEI

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August 27, 2013

Mr. Lek Kadeli
Principal Deputy Assistant Administrator
Office of Research and Development
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Washington, DC 20460

Dear Mr. Kadeli:

I am pleased to provide you with the response from the Health Effects Institute (HEI) to your letter of July 8, 2013, seeking HEI's advice and comment on the important questions of sharing the data underlying epidemiologic studies of air pollution and health.

As you know, HEI has a longstanding policy to make data underlying its studies available to the widest possible scientific audience. We accomplish this first by the publication of comprehensive, intensively peer-reviewed reports of all results of research we fund (not just those that investigators might select for publication in a peer-reviewed journal), and by making extensive additional details available on-line. We also endeavor, in cases where we have full ownership of and rights to data produced for our studies, to make those data widely available to other investigators, including publishing entire data sets and analytical programs on the web. While there are legitimate privacy concerns that must be addressed in making epidemiologic data with personal health and other information available to other scientific investigators, HEI has long believed that mechanisms can often be developed for doing so and it is the interest of science, and the public policy informed by such science, to find ways to do that.

It is in this spirit that we respond to your letter. We have both several general comments on the nature of the data, and observations on how data may be shared and results replicated, for the particular studies you cite which rely on the American Cancer Society Cancer Prevention Study II and Harvard Six Cities cohorts. We provide, as well, specific answers to your questions.

General Considerations on the Data

As you note in your letter, air pollution epidemiology studies normally rely on several types of data: air quality data, census-based covariate data (e.g. income levels within a zip code area where the study subject(s) reside), health event data (which in these studies are data from the National Death Index), and individual health and personal characteristics data (e.g. level of education, alcohol consumption, body mass index, and smoking behavior) which are gathered through detailed individual questionnaires and in some cases periodic health examinations. We have several general observations:

- Data sets that have been created from publicly available sources and contain no individual identifying information, such as air quality monitoring data and census-based covariate data, should be able to be made publicly available without tremendous difficulty or cost.

- Data from the National Death Index (NDI) – maintained by the Centers for Disease Control and Prevention – is generally made available to investigators upon certification on their part that they would not advertently or inadvertently release the identity or cause of death or any other identifying information of any individual. The NDI does make provisions for making its data available more broadly, but according to well-specified rules for aggregating the data and removing certain information (e.g. specific date of death), which would keep a third party from using the data to identify an individual.

- Data collected from individual subjects in a study which normally includes detailed personal, health status, and behavioral information, is critical to allowing for these studies to determine whether some other factor than air pollution (e.g. obesity or smoking behavior) may be responsible for any health effects that are observed. This data, which is normally collected through individual questionnaires and/or medical examinations, is collected with the *express commitment to the participants - from the organizations and the original investigators that collect the data - that the participants' personal information and identity will not be divulged.* Studies using this data are also subject to the Common Rule, under which investigators must apply to their respective Institutional Review Boards (IRBs) to ensure the protection of human subjects in biomedical and behavioral research.

Observations on Data Sharing and Full Replication of These Studies

The ACS and Harvard studies, at their root, attempt to determine whether persons living in higher pollution areas are more likely to have higher relative risks of premature mortality than those living in lower pollution areas, while attempting to control for a host of personal-level and community-level covariates that may also differ between the individuals and the communities. This by its nature requires knowing where the person lives, which can pose challenges for protecting the identity of an individual if s/he lives in a smaller or sparsely populated area. This challenge has been long recognized, and there are a number of protections in federal rules and scientific practice that address this (e.g. the Census Bureau will not release certain data at the block or even zip code level if they believe that would allow identification).

Since the goal should be to find ways to share data which enables full replication and sensitivity analysis of original studies, it is valuable to consider two aspects of these particular studies that have moved them towards using data at smaller spatial scales:

- First, in response to valid criticisms that the earlier versions of these studies relied only on central air quality monitoring data to estimate exposure, investigators have increasingly sought to better estimate exposure employing land use regression models and other methods that can account for the distance of a subject's home from roadways, industrial facilities, and other sources of air pollution. They have also applied increasingly finer-grained community-level covariates (e.g. at the zip code level). While in the largest locations the application of these finer-grained data would likely not allow

for identification of individual subjects, the national analyses in some of these studies include subjects from a wide range of community sizes, including smaller communities where identification could be possible.

It should be possible to produce a data set which uses techniques like land use regression to assign exposure levels to each subject in a study and to provide only that exposure value in a dataset made available to others. This would avoid the possibility of identification of an individual subject, and would allow for replication of the original results for a study that was analyzing a range of exposure across a specific metropolitan area, for example. But such a data set, absent location information for each participant, would not allow for sensitivity analyses applying different forms of exposure modeling nor full testing of the validity of the original study's exposure estimates.

- Second, as these studies have been reviewed intensively by the HEI Review Committee, the Committee has identified two potentially significant sources of uncertainty in their results: so-called "ecological confounding"[1] and "spatial autocorrelation."[2] This is detailed in the HEI Review Committee's Commentary on the most recent HEI Research Report of Extended Analyses in the American Cancer Society cohort (pp. 128-129 in Krewski 2009). To address both of these issues, one of the first steps that investigators have taken has been to use data at smaller scales, e.g. at the zip code level, which while enhancing their ability to test for these two sources of uncertainties, also poses the potential in smaller communities for individuals and their personal information to be identified.

Taken together, these characteristics – which have in general enhanced the quality and the sensitivity of the studies – increase the difficulty of providing a fully "de-identified" data set while *also* enabling a different investigator to conduct a full replication and sensitivity analysis of the original study results.

Options for Making Data Available – Answers to your Specific Questions

With these considerations in mind, we attempt to answer your specific questions below:

1) Who owns and/or holds the data necessary to replicate the relevant studies and what are the concerns, if any, associated with making such data publicly available?

The publicly available air quality and census covariate data are of course collected and owned by the government and are freely available. The air quality and census data sets created specifically by investigators for a particular study are generally the property of the investigators, but should be capable of being made available, especially in the case where they were created using public funds.

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[1] Ecological confounding arises when some community-level variables, which are themselves risk factors for mortality, are also associated with air pollution levels

[2] Spatial autocorrelation is the tendency for variables to have similar values for people or areas that are geographically close, which can suggest that there are other mortality causes which are unaccounted for in the analysis, or can distort the precision of risk estimates.

As to the ownership of the detailed participant data in the ACS and Harvard Six Cities cohort studies, HEI will leave the answers to the other two recipients of your letter – Harvard University and the American Cancer Society – who created these data sets, maintain them, and would have the most current information on others who may be holding these datasets in whole or in part. Those organizations also provided study participants with express commitments that their personal identity and information would not be divulged and have the responsibility to ensure that this commitment is not compromised during any data sharing.

2) What are the technical options for making these data publicly available, taking into account any concerns about the release of confidential personal health information or other confidential data? What are the implications of these options for replicating these studies? What level of effort in terms of time and resources would be required for these options?

3) If there are no feasible options for making all of the data publicly available, how would a researcher gain access to the full set of underlying data in order to replicate these studies? Please provide any documentation you believe would be helpful in understanding this process.

We see a range of options for making such data available, in different formats and with different procedures, so we are answering the questions jointly. In our view, it is feasible to share data in one of three ways (which have been used in many instances) and to do so while protecting the privacy of the individual subjects. The options range, however, from those that offer the most detailed access to study data to those that offer significantly less access:

A. **Collaboration with original investigators to obtain full access to data in order to conduct joint analyses**

This process is the most common practice in the scientific community for sharing personal data. It normally involves either formal or informal application processes for a scientific researcher to ask the original organizations and investigators who created the data set to gain access to the data to allow for collaborative analyses of an important research question. The American Cancer Society, for example, provides explicit instructions on their website on how to collaborate with them, and many other investigators have conducted more informal collaborations of a similar type. Such collaborations have, of course, to be conducted in full compliance with the Common Rule and any federal or other requirements for protecting the privacy of the participants.

The *advantage* of this process is that it can provide investigators with the fullest access to the data sets and with the benefits of regular consultation with the original investigators whenever there are questions about data structure or content. The *disadvantages* include that the original investigators may not choose to collaborate with all who request access, and a fully independent replication and sensitivity analysis of the original studies may not be possible or broadly accepted, given the collaborative relationship.

B. **Application to obtain independent access to analytic data sets sufficient to allow for replication and sensitivity analysis of the original results**

This process involves the request by a researcher to the original investigators, or to agencies and organizations, who created the data set to gain access to the data sets underlying a particular study. This normally would involve the development of a protocol for such analysis by the researcher, the review and approval of the protocol by the submitting scientists' IRB, explicit signed commitments by the researchers that they will not disclose personal information (on pain of penalty in the case of federally owned data sets), and usually other protections (e.g. prohibition of the publication of any results presenting data for groups of fewer than a certain number of subjects, and review by the original investigators before publication to ensure that no such information is inadvertently disclosed). Such a process is currently used within the US Department of Health and Human Services.

One relevant example of such data sharing is the detailed data sharing procedures established for the Multi-Ethnic Study of Atherosclerosis (MESA) which can be viewed at https://dbgap.ncbi.nlm.nih.gov/aa/wga.cgi?view_pdf&stacc=phs000403.v1.p3. In addition, MESA has created several "Limited Access Data Sets" in which personal identifying information has been removed and which can be accessed more readily, but which would not allow for full replication of original studies (see https://biolincc.nhlbi.nih.gov/studies/mesa/?q=MESA).

The *advantage* to this approach is that it can provide access to a substantial portion of the relevant data and allow for fully independent replication and sensitivity analyses of the original results. The major *disadvantage* is that this approach normally does not provide access to the full data set, but rather only to the detailed analytic data set or summary tables used in specific studies, thus precluding full replication.

A similar albeit much more intensive process enabled HEI and its independent investigators to gain access to the full data which we reanalyzed from the Harvard Six Cities Study and the American Cancer Society Study (HEI 2000). This process was structured to allow intensive efforts to replicate and test the robustness and sensitivity of the originally reported results. It was undertaken with the full agreement of, but not collaboration with, the original investigators, and provided full access to the data in accordance with a specifically developed data use agreement which ensured protection of privacy. The analyses were also informed by expert advisors from industry, academia, and other stakeholders.

C. **Provision of a "de-identified" disk (or other electronic medium) to provide a more limited data set that would not under any circumstances allow for identification of individuals**

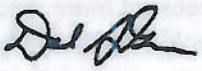
In some cases, the simplest mechanism for providing access to study data would be through the provision of a fully de-identified data set in electronic form that can be readily shared with all parties without the possibility of an individual and his or her personal characteristics to be divulged. This has the *advantage* that it may allow independent replication and sensitivity analyses of some of the results of the original investigators. The most significant *disadvantage* is that, as noted above, the most recent analyses in the ACS populations have applied increasingly finer-grained community level data analysis; the release of a fully "de-identified" dataset will not allow full replication and sensitivity analysis of these most recent results, e.g. the testing of

alternative models for estimating exposure among the study subjects, and the inability to test whether ecological confounding and spatial autocorrelation could be affecting the results.

Overall, HEI believes that the opportunity for other scientific investigators to have access to and conduct additional analyses in these epidemiologic data sets is of tremendous scientific value, and can provide additional understanding of important scientific questions that can in turn inform air quality policy decisions. As we have described, there are well-established processes for making such data available; however, not all processes provide the fullest access to the data required while still protecting the privacy of individual information that is essential to the studies.

We would be pleased to provide additional consultation on these important questions and to answer any questions you might have. Please let us know if you have further questions or need additional assistance in this effort. You may feel free to contact me or HEI Science Director Dr. Rashid Shaikh at rshaikh@healtheffects.org or (617) 488-2301 for any follow-up questions

Sincerely,



Daniel S. Greenbaum
President

cc: Dr. Rashid Shaikh
Dr. Susan Gapstur, American Cancer Society
Dr. Douglas Dockery, Harvard University

Health Effects Institute. 2000. Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality: A Special Report of the Institute's Particle Epidemiology Reanalysis Project. Health Effects Institute, Cambridge MA.

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September 6, 2013

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Dear Mr. Kadeli:

I am pleased to respond to your letter of July 8, 2013, seeking advice and comment on sharing the data underlying epidemiologic studies of air pollution and health. Let me address each of your three questions specifically.

1. Who owns and/or holds the data necessary to replicate studies and what are concerns, if any, associated with making such data publicly available?

This question makes several assumptions which must first be clarified.

WHAT IS MEANT BY REPLICATION?

Replication is the standard for scientific investigations. Replication implies independent data, analytic methods, laboratories, and methods (Greenbaum, Bachmann et al. 2001; Peng, Dominici et al. 2006). While replication is the standard in physical and biological (experimental) sciences, replication can be difficult in epidemiology (observational) sciences where it may be hard to find comparable data from independent populations.

True replication of long-term observational (epidemiologic) studies is time-consuming and costly. Nevertheless, there has been replication of the original air pollution mortality associations reported in the Six Cities study reported in 1993 (Dockery et al., 1993). Indeed, the subsequent analysis of air pollution associations in the American Cancer Society CPS II cohort (Pope et al., 1995) was undertaken explicitly as an independent replication of the observations in the Six Cities study of mortality associations with fine and sulfate particulate matter air pollution (Greenbaum, Bachmann et al. 2001). Since these original observational studies two decades ago, there have been numerous reported replications of the original findings in independent studies from the United States and Europe (see Table below abstracted from a recent review of these studies (Hoek, Krishnan et al. 2013)). The EPA particulate national ambient air quality standard is based on a review of all of this body of evidence and not solely on the Six Cities and ACS studies. The EPA benefit analyses used exposure response functions from these two studies because they represent the range of exposure response reported in the scientific literature.

Reproducing results implies that independent investigators subject the original dataset to their own analyses and interpretation (Peng, Dominici et al. 2006). Reproducing results does not provide the same level of independent replication, but at times can be the only feasible approach.

Several authors have advocated that data and analytic code should be routinely made publically available for epidemiology studies to allow for reproduction of published results (Peng, Dominici et al. 2006; Hernan and Wilcox 2009; Samet 2009).

In 1997, following calls for release of original data for the Six Cities and ACS analyses (Greenbaum, Bachmann et al. 2001), the Harvard and ACS investigators agreed to provide a copy of the analytic datasets and access to the original records to independent investigators selected by the Health Effects Institute, with appropriate assurances and oversight to ensure protection of participants' confidentiality. These data were subjected to validation of the data records, an attempt to reproduce the original results by independent analyses, and testing the sensitivity of the original published results to alternative assumptions, methods, and adjustment for additional potential confounders. This quality assurance check and reanalysis found the data to be of high quality, the results to be reproducible, and the findings to be insensitive to alternative analytic approaches and control of confounders. These results were published in a 293 page peer-reviewed HEI report (Krewski, Burnett et al. 2000), and published in the peer-reviewed scientific literature (Krewski, Burnett et al. 2003; Krewski, Burnett et al. 2005; Krewski, Burnett et al. 2005).

TABLE 1: Long-term cohort studies of the effects of particulate air pollution ($PM_{2.5}$, PM_{10}, and TSP) on mortality. Abstracted from Hoek, Krishnan et al (2013).

Study	Study population	Follow-up period	Pollutant	Authors	Publication Year
Harvard Six Cities	8111 adults in six US cities	1976 - 1989	$PM_{2.5}$	Dockery et al	1993
American Cancer Society (ACS) Study	552, 800 adults from 51 US cities	1982 - 1989	$PM_{2.5}$	Pope et al	1995
ACS Study	500,000 adults from 51 US cities	1982 -1998	$PM_{2.5}$	Pope et al	2002
ACS Sub-Cohort Study	22,905 subjects in Los Angeles area	1982 - 2000	$PM_{2.5}$	Jerrett et al	2005
Harvard Six Cities	8096 adults in six US cities	1979 -1998	$PM_{2.5}$	Laden et al	2006
German Cohort	4752 women in Ruhr area	1985 – 2003	PM_{10}	Gehring et al	2006
Women's Health Initiative Observational Study	65,893 postmenopausal women from 36 US metropolitan areas	1994-1998	$PM_{2.5}$	Miller et al	2007
Netherlands Cohort Study	120, 852 subjects from Netherlands	1987 -1996	$PM_{2.5}$	Beelen et al	2008
Nurses' Health Study	66,250 women from the US north eastern metropolitan areas	1992-2002	PM_{10}	Puett et al	2008

Medicare National Cohort	13.2 million elderly Medicare recipients across the USA	2000 - 2005	$PM_{2.5}$	Zeeger et al	2008
Nurses' Health Study	66,250 women from the US north eastern metropolitan areas	1992-2002	$PM_{2.5}$	Puett et al	2009
Swiss National Cohort	National census data linked with mortality	2000 - 2005	PM_{10}	Huss et al	2010
California Teachers Study	45,000 female teachers	2002 -2007	$PM_{2.5}$	Ostro et al	2010
US Trucking Industry Cohort	53,814 men in the US trucking industry	1985 -2000	$PM_{2.5}$	Hart et al	2011
Health Professionals Follow-Up Study	17,545 highly educated men in the midwestern and northeastern US	1989 – 2003	$PM_{2.5}$	Puett et al	2011
China National Hypertension Survey	70,497 men and women	1991 - 2000	TSP	Cao et al	2011
California Teachers Study	101,784 female teachers	1997- 2005	$PM_{2.5}$	Lipsett et al	2011
Chinese Retrospective Cohort Study	9,941 adults from five districts of Shenyang city	1998 -2009	PM_{10}	Zhang et al	2011
Vancouver Cohort	452,735 Vancouver residents 45–85 yr	1999 – 2002	$PM_{2.5}$	Gan et al	2011
Harvard Six Cities	8096 adults in six US cities	1974 - 2009	$PM_{2.5}$	Lepeule et al	2012
Nippon Data Cohort	7,250 adults > 30 yr throughout Japan	1980 - 2004	PM_{10}	Ueda et al	2012
Canadian National Cohort	2.1 million nonimmigrant Canadians . > 25 yr	1991 - 2001	$PM_{2.5}$	Crouse et al	2012
New Zealand Census Mortality Study	1.06 million adults in urban areas from 1996 census	1996 -1999	PM_{10}	Hales et al	2012
German Cohort	4752 women in Ruhr and surrounding area	1985 - 2008	PM_{10}	Heinrich et al	2013
Rome Longitudinal Study	1,265,058 adults from Rome	2001 - 2010	$PM_{2.5}$	Cesaroni et al	2013

WHO OWNS AND/OR HOLDS THE DATA?

Under the terms of the NIEHS grants and EPA contracts, the Six Cities data are owned and held by the President and Fellows of Harvard College. This ownership of the data by Harvard is well established legally.

WHAT ARE CONCERNS WITH MAKING SUCH DATA PUBLICALLY AVAILABLE?

Harvard has supported free exchange of data for reproducing and advancing scientific knowledge whenever individual privacy is not compromised.

A recent example was the release of lung function measurements of children in the Six Cities study collected between 1974 and 1989, for a multinational pooled analysis of normal values for children (Quanjer, Hall et al. 2012; Quanjer, Stanojevic et al. 2012). In this case, individual data including sex, race/ethnicity, age, height, weight, and lung function were released. Individual identifiers were not included and the characteristics released were not alone sufficient to allow identification of individual children.

In asking potential subjects to participate, we assured all participants that their individual data would not be released to anyone other than the study investigators (see below).

In the case of mortality records, there are a variety of standards. Individual death records are compiled by each state, and forwarded to the National Center for Health Statistics (NCHS). Death records are made available to researchers in several forms. Surveillance data of deaths have previously been available by county and death date from the National Center for Health Statistics. While these data sets did not include individual identifiers prior to 1989, they did include sex, age, race/ethnicity, date of death, county of death, and primary cause of death. However, concerns with privacy of death data have led to increasing restrictions on the identifiable data (Centers for Disease Control and Prevention 2013).

Over the years, confidentiality standards have changed for the public release of geographic and date details on vital statistics micro-data files (Centers for Disease Control and Prevention 2013). These changes are reflected in the data available in successive time periods, as follows:

- Prior to 1989, NCHS public-use death micro-data files contained all counties and exact dates (year, month, and date) of deaths.
- Between 1989 and 2004, public-use death micro-data files contained only geographic identifiers of counties and cities with a population of 100,000 or greater, and no exact dates of death (year, month, and day of week, e.g. Monday, only).
- Beginning in 2005, public-use death micro-data files contained individual-level vital event data at the national level only, that is, with no geographic identifiers (no state, county, or city identifiers), and no exact dates of death (year, month, and day of week, e.g. Monday, only).

Thus, since the study was published in 1993 there has been a substantial shift in the standards for confidentiality of death records, as reflected by the practices of the National Center for Health Statistics of the Centers for Disease Control and Prevention.

Since 1979, individual death records have been compiled into the National Death Index, a national resource for follow-up studies. Investigators may apply to the NDI to search for deaths of study participants. NDI requires informed consent of the study participants, institutional review board oversight, and assurances that identifiable data are not released. Standards for release of death data vary between states. In some states, death records are considered public and are readily available. In other states, death records are considered private, and are available only to next of kin (immediate family).

Prior to the creation of the National Death Index, the Six Cities Study investigators had to apply to each state to obtain copies of death certificates. Cause of death was coded by a certified nosologist from the original death certificate. Release of death data was then dictated by the most restrictive state privacy requirements.

EXAMPLES OF REPRODUCTION

In the case of non-identifiable mortality data, Harvard investigators have worked with interested independent investigators to replicate published findings. For example, the 1996 study entitled "*Is daily mortality specifically associated with fine particulate air pollution*" examined the effect of acute air pollution exposures on counts of daily mortality in the Six Cities Study communities (Schwartz, Dockery et al. 1996). In a replication/reanalysis exercise sponsored by the Electric Power Research Institute, independent investigators at Klemm Associations were provided with copies of the original data. They attempted to reproduce the original mortality data, replicate the original analyses, and assess the sensitivity of the analyses to alternative methods and control of covariates. This led to joint (Klemm, Mason et al. 2000) and independent (Klemm, Mason et al. 2000) peer-reviewed publications.

A more recent study examined the association of changes in county-specific life-expectancy with changes in fine particle air pollution in 211 counties in the United States between 1980 and 2000 (Pope et al., 2009). These data were compiled from publically available datasets and included no individual death records. Copies of these data were provided to interested individual investigators including Dr. Goran Krstić of Fraser Health in British Columbia, Dr. James Enstrom of the Scientific Integrity Institute, and Dr. Stanley Young of the National Institute for Statistical Sciences (a private, nonprofit organization in Research Triangle Park, NC). These re-analyses have led to a lively debate in scientific literature. Dr. Krstić published a critique in 2012 (Krstic 2012). Dr. Enstrom presented his reanalysis at a symposium (Enstrom 2010). Dr. Young has presented his results orally (Young 2010) and more recently in the peer-reviewed literature (Young and Xia 2013). The original authors published responses to these critiques in peer-reviewed journals (Pope, Ezzati et al. 2013), as is normal practice in scientific debate.

As these re-analyses illustrate, there has not been a question of availability of mortality/air pollution data when individual death records are not involved.

2. What are the technical options for making these data publicly available, taking into account any concerns about release of confidential personal health information or confidential data? What are the implications of these options for replicating these results? What level of effort in terms of time and resources would be required for these options?

Release of identifiable individual data would violate the assurances of confidentiality required by the Harvard Human Studies Committee (Institutional Review Board) and given to each study participant upon their enrollment into the Six Cities Study. As participants were enrolled into the study, they signed the following "*Assurance of Confidentiality,*" also signed by Benjamin G. Ferris, Jr., the Principal Investigator of the study, and by a witness:

> *Harvard University School of Public Health hereby gives the assurance that your identity and your relationship to any information obtained by reason of your participation in this study of respiratory symptoms will be kept confidential and will not otherwise be*

disclosed except as specifically authorized by you. The data from individuals will be pooled and used as group data in scientific studies.

As custodians of these data, we consider that we are obligated to maintain the commitment to maintain this Assurance of Confidentiality made with each participant in the study.

In addition, release of identifiable individual death records would violate the agreements with the National Death Index and with the individual state agencies to obtain copies of the individual death records. For example, the original application requesting data from the National Death Index includes the following *Applicant Assurance*:

The identifiable data obtained from the National Death Index will be used only for research and statistical purposes. With the exception of requests for death record information made to the appropriate State vital statistics office, no data will be published or released in any form if a particular individual or establishment supplying the information or described in it is identifiable.

In addition, we had to apply to each state vital statistics division to obtain copies of death records. In each case, we had to provide assurances of confidentiality of these vital records. For example, the Missouri Division of Health required:

The request will be approved only if adequate assurances are provided to protect the confidentiality of the records requested. This includes limiting access to the records only to members of the research staff, not releasing records to other agencies, publishing data so individuals cannot be identified, destroying the records upon completion of the study, and not contacting family members or acquaintances of decedents or infants without written permission from the Director of the Missouri Division of Health.

Thus we also have made very explicit institutional commitments to protect the confidentiality of the death information of participants in the study.

DATA REQUIRED FOR REPRODUCING RESULTS

What data are required to reproduce the results of the 1993 mortality analyses (Dockery, Pope et al. 1993), the 2006 mortality follow-up (Laden, Schwartz et al. 2006), or the most recent mortality follow-up (Lepeule, Laden et al. 2012)? There are three classes of data required for these analyses: exposures, health outcomes, and the covariates (or confounders). Let us consider each of these separately starting with exposures.

For these analyses, the exposures are community level air pollution concentrations. Air pollution concentrations are publically available. This study included annual mean air pollution concentrations collected specifically for this study at a centrally located site in each community. There is no issue with making these air pollution data publically available. However, to conduct the analysis, the residency of each research participant must be linked to the exposure data, resulting in the identification of the subjects' city of residency.

The health outcome is time to death (or cause-specific death) from the start of the study for each individual. This requires knowing when a person was enrolled in the study, when they died and cause of death, and if they did not die or were lost to follow-up, the date of last contact.

The covariates that need to be considered for reproducing the results are other predictors of death. In this analysis, the covariates included age, sex, race, smoking (indicators of current

and former smoking, number of pack-years smoked), education (indicator of less than high school), and body-mass-index. Defining exposure required knowing city of residence at enrollment into the study. Knowing their individual characteristics alone would not be sufficient to identify an individual in the study. As noted above, these types of non-identifiable data have been released to other researchers. The difficulty arises when these individual characteristics (covariates) are combined with death records (date of death) and exposure information (place of residence).

De-identification is not simply the process of removing names and addresses. To illustrate the difficulty of ensuring privacy with respect to death records, consider a study participant in Watertown, Massachusetts, the first city enrolled in the study. The 1990 census population of Watertown was 33,284. Assuming a national average death rate of 799.5/100,000 per year (Centers for Disease Control and Prevention 2013), we would expect less than one (0.73) death per day. Knowing a participant from Watertown died on a specific date would almost certainly allow identification of that individual from published obituaries, and hence is considered identifiable information. Knowing the person's age, sex, and race as required to reproduce the analyses would leave no doubt of their identity. The table below presents the 1990 census population for each of the Six Cities and estimated numbers of deaths per day.

TABLE 2: 1990 census population in each of communities in the Harvard Six Cities Study, and expected number of deaths per day based on US average death rates (Centers for Disease Control and Prevention 2013)

Study Community	1990 Population	Expected Deaths/Day[†]
Portage/Pardeeville/Wyocena, WI	10,890	0.24
Kingston/Harriman, TN	11,671	0.26
Steubenville, OH	22,125	0.48
Watertown, MA	33,284	0.73
Topeka, KS	119,883	2.63
St. Louis, MO[*]	396,685	8.69

[†] *Assuming US average of 799.5 deaths/100,000/year*

**Note: St. Louis sample only included residents of the Carondelet section of St. Louis. Census is for entire city.*

Thus knowing the date of death plus the essential individual characteristics for these analyses – sex, age, and city of residence, is sufficient to identify individual study participants. Furthermore, even knowing the year of death, in combination with sex, age and city of residence would be sufficient to identify most participants.

For comparison, as noted earlier, prior to 1989 the National Center of Health Statistics only released public use data specifying date of death and county of residence. This was subsequently changed to specify only counties with population greater than 100,000, and date was reported only as year, month, and day of the week. Currently, public-use death data are only

available without specification of county of residence and no exact dates of death are provided (year, month, and day of week only).

3. If there are no feasible options for making all the data publically available, how would a researcher gain access to the full set of underlying data in order to replicate these studies? Please provide any documentation you believe would be helpful in understanding this process.

First, we would like to note that as indicated above, the results of the Six City Study have been both replicated and reproduced. More broadly, we have struggled with the competing demands of providing full access to policy-relevant observational public health data while maintaining the confidentiality of personal data for more than 15 years. As illustrated in the previous sections, these issues have been the subject of vigorous debate. Based on this experience, we would suggest that there are two approaches to allow independent researchers to gain access to the full set of underlying data.

The first approach would to provide access to all the data as we did in response to the EPA request in 1997. On January 31, 1997, Mary Nichols, EPA Assistant Administrator for Air and radiation wrote to Dr. Dockery stating in part:

> *"As you know, there has been considerable interest in your research on the health effects of air pollution, including requests by members of Congress, governors of several states, and other for the raw data underlying your published research. ... (G)iven the strong interest in your research, EPA would encourage reasonable accommodations with the scientific and governmental community that would permit other interested scientists and agencies to understand fully the basis for your work. We therefor request that you make data associated with your published studies available to interested parties as rapidly as possible."*

After thoughtful consideration of this request, in April 1997 we asked an outside, independent agency, the Health Effects Institute (HEI), to provide an independent, comprehensive review and re-evaluation of the study data. We agreed to turn over a complete copy of all the data and provide access to all original records to HEI. There were no constraints on analyses or questions that the HEI investigators could explore. However, the HEI investigators were required to apply for and receive approval from the same agencies and institutional review boards that approved the original Harvard study that generated these data. In addition, the data were kept on a secure computer, not connected to the web or network, to ensure data security.

HEI assembled an Expert Panel to provide scientific oversight of the reanalysis project. The HEI Expert Panel had an open competition for a team of investigators to conduct the reanalyses. Harvard had no input into the process of selecting the independent scientific review team. A team from the University of Ottawa was selected.

HEI also established an Advisory Board to provide stakeholder participation (Health Effects Institute 2000). HEI solicited and compiled questions broadly through open solicitation and public meetings.

In 2000 the independent investigators produced a report which was peer-reviewed and then reviewed by the Expert Panel. The Harvard investigators were given an opportunity to comment on the report but not to edit it. The report, Expert Panel review, and original investigator comments then were published by HEI (Krewski, Burnett et al. 2000). In addition,

the results have been published in the peer-reviewed scientific literature (Krewski, Burnett et al. 2003; Krewski, Burnett et al. 2005).

This complete access approach provided a transparent review of the quality of the data, reproduction of the original results, and analyses of the sensitivity of the findings to alternative methods and control for alternative explanations. While this process was comprehensive and successful, it was also long and expensive, making it less than an ideal model (Greenbaum, Bachmann et al. 2001). Moreover, since the data integrity and findings of the Six Cities study already has been reproduced, the argument for repeating this process seems weak.

The alternative approach is to allow specific, restricted access to interested investigators. As a groundbreaking study and as a valuable data resource, the Six Cities Study remains a potential resource for additional analyses. The Harvard investigators have been and continue to be open to collaborating with interested, qualified investigators to fully explore the use of these observational data for discovery and better understanding.

Interested investigators may apply to use specific data to address specific questions. This approach has been used in several similar large observational studies.

For example, the American Cancer Society (ACS) has a well-defined procedure for outside investigators to propose questions that could be addressed using the Cancer Prevention Studies (American Cancer Society 2013). Similarly, at Harvard, the Nurses' Health Studies have established procedures for proposing use of the data sets (Nurses' Health Study 2013).

Following the model of the procedures for the American Cancer Society and the Nurses' Health studies, we could create a formal procedure for requesting and monitoring access to data from the Six Cities Study, managing and monitoring analyses, and monitoring dissemination of results.

The first step would be to establish an independent expert panel to establish procedures, review applications, and monitor the process. One option would be to ask the existing *External Advisory Committee* of the Harvard Clean Air Research Center to take on this task.

Requests for access to data would require a formal application to the *External Advisory Committee*. Following the examples of the ACS and Nurses' Health studies, such an application could include the following elements:

- Specific hypothesis of the proposed analysis
- Scientific significance of the project
- Data variables required and analysis plan
- Reasons for proposing use of these data, rather than another source
- Sources of funding
- Qualifications of external investigator
- Identification and agreement of collaborating Harvard investigator

Upon approval of the *External Advisory Committee*, the external and Harvard investigators would enter into a formal agreement, which, again based on ACS and Nurses' studies examples, could include the following elements:

- All primary data, computer programs, and analysis results would be maintained on the Harvard computer servers, and all data analyses will be conducted on Harvard computers.

- Agreement on the role of Harvard collaborator(s) on the project, and authorship for specific publications arising from the work using the Harvard data.
- At least one member of the Harvard investigative team would be a coauthor on any manuscript resulting from this collaboration and, as such, would need to approve any manuscript prior to its submission for publication.
- Certification of Human Subject training for each investigator and approval from the Harvard School of Public Health Human Subjects Committee (Institutional Review Board).
- Prohibited use of the material for any purpose other than that explicitly stated in the proposal.
- Guarantee of the confidentiality of any data arising from the study, and agreement not to release data to any other person or group for any purpose, except with the explicit permission of Harvard investigators.
- Specification of terms for payment for time and effort by Harvard investigators.

As noted above, these procedures have been commonly applied in providing access of interested investigators to similar population based studies, while protecting confidential individual information. Given others' successful experience with this approach, Harvard stands ready to work on such a process with interested investigators.

I hope you find these comments helpful, and I would be pleased to provide additional consultation on these important questions. Please let us know if I can be of further assistance in this effort.

Best regards,

Douglas W. Dockery, ScD

xc: Michael Grusby, Catherine Breen

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CONGRESSIONAL AND
INTERGOVERNMENTAL RELATIONS

The Honorable Lamar Smith
Chairman
Committee on Science, Space, and Technology
United States House of Representatives
Washington, DC 20515

Dear Chairman Smith:

Thank you for the opportunity to respond to the questions for the record from the House Committee on Science, Space, and Technology's hearing on November 14, 2013 entitled, ***Strengthening Transparency and Accountability within the Environmental Protection Agency.*** Please find our responses in the attached document.

Again, thank you for your letter. If you have further questions, please contact me, or your staff may call Christina J. Moody, in the EPA's Office of Congressional and Intergovernmental Relations, at (202) 564-0260.

Sincerely,

Nichole Distefano
Deputy Associate Administrator

Enclosure

cc: The Honorable Eddie Bernice Johnson
Ranking Member

Questions for the Record
U.S. House of Representatives
Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency
November 17, 2013

Questions from Lamar Smith

Hydraulic Fracturing Study Questions

Question 1: EPA's Hydraulic Fracturing Study is concerning because EPA is searching for what is possible without paying attention to what [is] probable. For example, the primary goals of the study are to answer questions such "What are the possible impacts of hydraulic fracturing fluid surface spills on or near well pads on drinking water resources?" It appears EPA's independent science advisors share this concern. For example, one SAB expert commented that "There is no quantitative risk assessment included in EPA's research effort. Thus, the reader has no sense of how risky any operation may be in ultimately impacting drinking water. This is also a significant limitation of the work."

Answer: Consistent with the scope defined by Congress in its request, the goal of EPA's report is to provide an assessment of the potential for hydraulic fracturing activities to impact the quality or quantity of drinking water resources in the United States. The goal of this report is to identify factors affecting the frequency and severity of impacts. EPA's report will represent a state of the science synthesis of information concerning the subject and will be national in scope. We did not conduct site specific or national predictive modeling to quantitatively estimate environmental concentrations of contaminants in drinking water resources. The report will not be a human health exposure assessment, it will not identify populations at risk, nor estimate human health impacts. The research approach was reviewed and supported by the EPA's independent Science Advisory Board. The findings from the study's individual research projects will be peer reviewed upon their individual completion. The study's assessment report has been designated a Highly Influential Scientific Assessment (HISA) and EPA is adhering to a rigorous, transparent peer review of the data and conclusions of the study. As a HISA, draft assessment will receive the highest level of peer review in accordance with EPA's Peer Review Handbook. The draft assessment report will be released for external, independent peer review by the Science Advisory Board (see http://www.epa.gov/hfstudy/peer-review.html).

Question 2: The Director of EPA's Office of Science Policy, Dr. Hauchman, stated in May 2012 that the Agency is implementing a "pretty comprehensive look at all the statutes to determine where "holes" may allow for additional federal oversight."
Is this study part of that comprehensive look? What statutes were looked at as part of this effort? What regulatory "holes" has EPA identified?

Answer: Dr. Hauchman was referring to the fact that the EPA is engaged in multiple activities related to hydraulic fracturing, not that the EPA is conducting a formal cross-statutory review. These activities are described on the EPA's web page: http://epa.gov/hydraulicfracturing.

Question 3: Given that there have been no proven instances of groundwater contamination, and that greenhouse gas emissions have actually declined thanks to natural gas, what problems are you seeking to solve?

Answer: The EPA is conducting this study in response to a request from Congress to investigate the potential impacts of hydraulic fracturing for oil and gas on drinking water resources. The study, which benefits from extensive stakeholder input and a scientific peer review by the Science Advisory Board, is designed to evaluate what impacts, if any, may be associated with each stage of the hydraulic fracturing water cycle. EPA is committed to studying and addressing potential concerns related to unconventional oil and gas development so that the public has confidence that it will proceed in a safe and responsible manner. In so doing, we will continue to follow a transparent, science-driven approach with significant stakeholder involvement.

Question 4: What has the Agency done to prevent repeating mistakes made in Parker County, Pavillion, and Dimock regarding fracking? Please include specific policy and protocol changes and actions taken.

Answer: In the three investigations referenced in your question, the EPA took action when the agency became aware of information indicating potential threats to human health. The EPA's actions generally focused on obtaining additional data and information in an effort to better understand and assess potential threats to public health and the environment. The agency consulted with its state and tribal partners prior to taking such measures and shared data and information with homeowners, the relevant state agencies, and where applicable, tribal authorities. In each case, the EPA relied upon sound science as it sought to provide clarity to these stakeholders and ensure that public health was protected, while working closely with individual states which have key regulatory authority relevant to unconventional oil and natural gas extraction. Beyond these instances, the EPA will continue to work with state partners and other stakeholders to study and address potential concerns related to unconventional oil and gas development so that the public has confidence that it will proceed in a safe and responsible manner.

The EPA is currently conducting a study to look at potential impacts of hydraulic fracturing across the nation. The agency's *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* is being conducted in accordance with the EPA Scientific Integrity Policy[1] and the principles laid out in the request from Congress.

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[1] U.S. EPA Scientific Integrity Policy, http://www.epa.gov/osa/pdfs/epa_scientific_integrity_policy_20120115.pdf

Question 5: Has EPA rescinded the draft Pavilion report and if the draft report has been removed from the hydraulic fracturing drinking water study and Scientific Advisory Board scope?

Answer: As you may be aware from our statement at the time of the State of Wyoming's announcement on June 20, 2013, we believe that the EPA's focus should be on using our resources to support Wyoming's efforts, which will build on the EPA's monitoring results. In light of the State's commitment to further investigation and efforts to provide clean water to Pavillion residents, the EPA does not plan to finalize nor seek peer review of its draft report.

EPA Region 8 maintains a website (http://www2.epa.gov/region8/pavillion) with information about the Pavillion investigation. It includes a chronology of events and hyperlinks to relevant information and reports dating back to August 2009. This chronology includes information regarding the June 2013 announcement that Wyoming would further investigate drinking water quality in the area east of Pavillion. Region 8 will continue to update its website to include additional milestones reached by the State, including a link to the Wyoming Oil and Gas Conservation Commission (WOGCC) website (http://wogcc.state.wy.us/pavillion_wrk_grp.cfm) where the State's August 5, 2014 Well Integrity Review draft report and Appendices can be found.

Question 6: In addition to the retrospective and prospective case studies, it is our understanding that there are 18 additional research projects that EPA had undertaken to help answer the secondary research questions of the study.

- How is EPA conveying the information from these projects to the public?

Answer: The EPA is fully committed to sharing information with the public about our research projects and our findings. The agency has held numerous public information sessions, workshops, roundtables, and webinars to update interested stakeholders about our research activities, and we have posted extensive information on the study website. Externally peer reviewed papers associated with the EPA research projects have been posted and, as papers are peer reviewed and completed, will be posted on the agency's website. Papers that have already undergone peer review can be found at: http://www2.epa.gov/hfstudy/published-scientific-papers.

- Will details be posted on the study website?

Answer: Yes, the website is regularly updated with study updates, meeting materials, published papers, and opportunities for participation.

- What is the plan for peer review of the completed projects?

Answer: Results from individual research projects ndergo peer review prior to publication either as articles in scientific journals or as EPA reports. Each project was reviewed, consistent with OMB's Bulletin on Peer Review, to determine the appropriate level of peer review. Furthermore, articles submitted to journals will be reviewed according to the journals' peer review process, external to the EPA. Projects written up as the EPA reports will undergo contractor-led peer reviews.

- What is the role of the SAB Hydraulic Fracturing Research Advisory Panel with respect to these projects and their final reports?

Answer: The SAB Hydraulic Fracturing Advisory Panel, which is an ad hoc panel of independent experts under the auspices of the SAB, is providing periodic advice and review of the EPA's hydraulic fracturing research. In May 2013, the panel reviewed the study's Progress Report and offered the public an opportunity to provide oral and written comments for consideration by the individual panel members. The EPA is considering the individual panel experts' comments in the development of the draft hydraulic fracturing drinking water assessment report, which will be released for public comment and a formal SAB peer review.

The Panel will review the draft hydraulic fracturing assessment report and will not peer review EPA's separate research projects. EPA's individual research projects will be reviewed consistent with the OMB's Bulletin on Peer Review prior to inclusion in the assessment report, as described in more detail above.

- What is the role of the SAB Hydraulic Fracturing ad hoc panel?

Answer: The answer to the previous question, see above.

The SAB Hydraulic Fracturing ad hoc panel will review the EPA assessment report on the potential impacts of hydraulic fracturing for oil and gas on drinking water resources. This assessment report has been designated as a highly influential scientific assessment (HISA. The Panel will receive an update from ORD on its study of the potential impacts of hydraulic fracturing for oil and gas on drinking water resources during a public teleconference prior to the release of the draft assessment report for formal SAB peer review and public comment.

- What is the ad hoc panel's review schedule for the remainder of the study?

Answer:

The EPA plans to brief the SAB ad hoc panel on the progress of research prior to the release of the draft assessment report for formal SAB peer review and public comment.
The EPA is considering the individual panel experts' comments on the progress report in the

development of the draft hydraulic fracturing drinking water assessment report. Our current timeline for release of the study for public comment and a formal SAB peer review is early 2015.

Question 7: Is EPA planning to release the raw data from the five Retrospective case study sites to the public via the study website? If so, when will that be available and will the needed context be included when released?

Answer:
Yes. The data and the five retrospective case study reports will be posted on the study website following peer review and report completion.

Question 8: Have states been forthcoming with data under current Request for Information on the September 2012 study? If not, how have you reached out to these states, particularly those states where a retrospective case study is located?

Answer: State input has played an important role in the development and execution of the *EPA's Study of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources*. During the development of the study plan, the agency held webinars and in-person public informational meetings in Texas, Colorado, Pennsylvania, and New York to obtain feedback on the EPA's proposed activities. In the execution of the study, the agency coordinated with states on research conducted in the field, including the retrospective case studies, and in the analysis of data obtained from the states. Webinars, technical roundtables and workshops, requests for information through the *Federal Register*, and public comment periods associated with the SAB review of the Progress Report continue to provide states and other stakeholders with information updates and opportunities for input on the agency's hydraulic fracturing research activities. We have recently intensified our state outreach efforts as part of the study. These efforts will ensure that states understand the data sources we used, and will provide them further opportunity to recommend additional sources of information. Moving forward, the EPA will continue to engage with the states.

Question 9: Has the EPA done any testing in real time for sites that are currently being developed? If not, does the agency plan to do testing in real time at any sites?

Answer: We have worked closely with industry partners to try to identify suitable locations for prospective case studies that meet the scientific needs of the study and industry's business needs. We continue to explore opportunities and so far we have not identified a suitable location. For a location to be suitable, it is necessary to gather a minimum of one year of characterization data for ground water and surface water prior to and following unconventional exploration activities in the study area, and for there to be no other hydraulic fracturing activities on adjacent properties during the entire study period, which could last several years.

Question 10: What has been your work with DOE and USGS to date on the study?

Answer: The EPA, DOE, and USGS routinely exchange information regarding ongoing and planned research. Exchanges among principal investigators, in addition to high level discussions, help to assure that information about the research, relevant papers, models, and data are shared and can be used to inform work underway by others. In addition to these consultations, as part of the study's research project on Subsurface Migration Modeling, the EPA is working with DOE's Lawrence Berkeley National Laboratory to explore the potential for hydraulic fracturing fluids to move from the fractured zone to drinking water resources.

Question 11: How are you accounting for fracturing technology innovations as part of the study?

Answer: To ensure that the EPA is up-to-date on evolving hydraulic fracturing practices and technologies, the agency requested relevant data and scientific literature to inform the study through a *Federal Register* Notice. The EPA has solicited relevant information from experts and the public through ongoing stakeholder engagement activities. More than 100 experts participated in a series of technical workshops EPA held in 2013 to engage stakeholders and solicit information regarding technology innovations. In November 2013, the Science Advisory Board held a meeting and specifically requested input regarding technology innovations. The agency is also conducting a comprehensive literature review that will contain the most recent technical information regarding developments in hydraulic fracturing.

Question 12: Do you believe hydraulic fracturing can be performed in a safe and responsible manner?

Answer: Responsible development of America's unconventional oil and natural gas resources offers important economic, energy security, and environmental benefits. The EPA is committed to studying and addressing potential concerns related to unconventional oil and natural gas development so that the public has confidence that it will proceed in a safe and responsible manner. In so doing, we will continue to follow a transparent, science-driven approach with significant stakeholder involvement.

Question 13: Could you tell us what plans the EPA has for addressing methane- particularly in regards to midstream and upstream systems?

Answer: In support of the Administration's Strategy to Reduce Methane Emissions, EPA released a series of five white papers on potentially significant sources of volatile organic compound (VOCs) and methane in the oil and gas sector for input from a panel of independent experts. The white papers focus on technical issues covering emissions and mitigation techniques. EPA will use the papers, along with input from the experts and technical input and data from the public to determine how to best pursue further reductions

from these sources. The papers do not draw policy conclusions.

Question 14: If the EPA sets a lower NAAQS of 60 to 70 parts per billion for ozone, do you believe there will be parts of the country that cannot meet the new standard due to background concentrations of ozone? If so, what would be the economic and regulatory consequences for a state that cannot meet the new standard?

Answer: Our modeling suggests that mean background ozone levels over the U.S. are approximately 25-45 ppb and that the upper end of background levels (i.e., 95th percentile) are less than 55 ppb even at the sites most influenced by background such as high-elevation sites in Western US. We don't expect there to be parts of the country that couldn't attain a lower NAAQS level of 70 or 60 ppb solely due to background. EPA is currently working on the revised ozone standard and has not made a decision yet about what standard it will propose.

By law, the EPA must set the ozone national ambient air quality standards (NAAQS) at a level to protect public health, regardless of where the ozone originates. However, the EPA does not expect states to limit naturally occurring ozone or ozone formed from emissions outside their jurisdiction. The Clean Air Act contains provisions that facilitate excluding high ozone values that meet the definition of exceptional events (section 319), and attainment planning provisions that do not penalize states if attainment is not possible due to international influences (section 179B).

Question 15: Is it fair for the EPA to include Mexican and Canadian emissions in its background estimates when the states will be forced to control for international ozone emissions?

Answer: States will not be forced to control for ozone formed from emissions outside their jurisdiction, including ozone formed from international emissions. The Clean Air Act contains provisions that facilitate excluding high ozone values that meet the definition of exceptional events (section 319), and attainment planning provisions that do not penalize states if attainment is not possible due to international influences (section 179B).

In the current NAAQS review, the EPA will be providing estimates of "U.S. background" which assumes that Canada and Mexico are part of the background and therefore not part of the controllable emissions.

General Air Pollution/NAAQS

Question 16: Considering the limits of science and technology, what is EPA's strategy for working within the framework established by Congress to effectuate the NAAQS?

Answer: As required by the Clean Air Act, the EPA reviews the NAAQS on a 5-year cycle.

After considering the body of scientific evidence on the effects of air pollution on public health and welfare, the agency determines whether the current standards provide an adequate level of protection for public health and welfare or whether the standards should be revised to meet the requirements of the Act. After a standard is set, the EPA works with state, local and tribal partners to implement it.

Question 17: Because of many factors, such as regulatory uncertainty, the funding for and construction of new long-term, base load power is dwindling. How do you balance new regulations that may benefit human health and the environment via decreased emissions against increased energy costs and the possibility of increased blackouts –both of which have a negative impact on human health?

Answer: For 40 years, we have been able to both implement the Clean Air Act and keep the lights on. We don't intend to change that. As you note, the changes in the power sector are driven by several factors. However, many experts, including the Energy Information Administration and Congressional Research Service, agree that the primary driving factor influencing power sector business decisions is low natural gas prices. The EPA works with power sector stakeholders as we develop our policies to identify challenges and provide flexibilities as appropriate to make compliance easier and less expensive. We work with utilities, system operators, state and federal regulators as these stakeholders work together to address local reliability. Although the EPA, as required by the Clean Air Act, does not take costs into account in setting the NAAQS, the EPA does examine the health and environmental benefits and economic impacts of its regulations, including analysis of energy prices and output, changes in electricity generation mix, impacts on reserve margins for reliability, and other energy-related metrics. For example, analyses by the EPA and the DOE on the EPA's Mercury and Air Toxics Standards (MATS) indicate that there will be more than enough electric generating capacity to meet the nation's needs. Meanwhile, the human health benefits from air quality improvements due to MATS implementation totals up to $90 billion each year. Additionally, looking at fossil generation greater than 250 MW that is currently being developed, approximately 6 GW of new capacity is expected to come online in 2015, which is higher than the average for the 2000s (NEEDS 5.13).

Question18: What is your vision to address international transport and what is your plan for equipping states to address these issues?

Answer: The EPA continues to evaluate the international transport of air pollution to ensure that we fully understand and appropriately account for the impacts of this pollution in developing efficient and effective programs for meeting national air quality health standards. To date, science shows that international transport of air pollution can affect air quality in the U.S. at different times and in different locations. However, studies show that domestic sources of emissions are the primary cause of the ambient concentrations of criteria pollutants in the U.S.

The EPA does not expect states to limit naturally occurring ozone or ozone formed from

emissions outside their jurisdiction when implementing the NAAQS. The Clean Air Act contains provisions that facilitate excluding high ozone values that meet the definition of exceptional events (section 319), and attainment planning provisions that do not penalize states if attainment is not possible due to international influences (section 179B).

Question 19: Do you believe EPA has legal authority to require changes from other nations in order to address international transport?

Answer: The EPA does not have legal authority to require changes from other nations in order to address international transport except as provided in international agreements. The EPA has worked successfully with Canada under the U.S.-Canada Air Quality Agreement (1991) and with Mexico under the U.S. – Mexico La Paz agreement (1983) to reduce transboundary air pollution affecting the U.S. In addition, the EPA works with other nations under multilateral environmental agreements that address international air pollution transport including the Convention on Long Range Transboundary Air Pollution, and will do so under the newly established Minamata Convention on Mercury when it enters into force. Another multilateral environmental agreement under which we could work with other nations to address international air pollution is the Stockholm Convention on Persistent Organic Pollutants, signed in 2001, for which implementing legislation and Senate advice and consent is pending. The EPA also works with other nations through Annex VI to the International Convention for the Prevention of Pollution from Ships to address air pollution transport from international shipping. In addition, the EPA has been collaborating with China for over a decade to exchange best practices for understanding and addressing air pollution. This cooperation is giving China technical and policy tools and approaches to help them reduce pollution from power, industrial and transportation sources, thereby reducing pollution that contributes to international transport.

Question 20: What is EPA's plan to address the imbalance created via the adoption of standards and requirements without the tools necessary to demonstrate compliance?

Answer: Although courts have recognized that EPA is not legally required to issue implementation guidance when adopting new or revised standards, EPA customarily evaluates the need for any such additional guidance or implementation rules as a matter of discretion. For example, EPA will often issue an implementation rule and, as appropriate, policy and/or technical guidance that, for example, describes the designations process and schedule, requirements for PSD and NSR programs, and process and schedule for submitting approvable State Implementation Plans. We also provide guidance to address state-specific or source-specific implementation issues that are brought to our attention. Finally, as we did in the 2012 $PM_{2.5}$ NAAQS final rule, we consider whether to include grandfathering provisions to facilitate a smooth transition to any new or revised standards that would apply to permitting for major sources in attainment areas.

Question 21: Is it possible to propose and adopt a new standard and the implementation rule and/or guidance at the same time? If so, can you commit to adopting the new standard and

the implementation rule and/or guidance at the same time? Why or why not?

Answer: In cases where there may be novel issues raised by the adoption of a new or revised national ambient air quality standard, the EPA's goal is to provide timely updates as necessary to address these issues in rules and guidance to implement the new or revised standards. Only certain Clean Air Act requirements demand compliance at the same time as a new standard is adopted (e.g., new source preconstruction permit requirements that apply in attainment areas), and the EPA's goal is to assess what is needed and provide the appropriate updates to rules, tools, and guidance to address those immediate compliance requirements within the same timeframe that the standard is adopted. For Clean Air Act requirements that do not demand compliance for several years after a new standard is adopted, the EPA's goal is to assess and provide any necessary guidance at a reasonable time in advance of the compliance deadline.

Question 22: Does EPA have any plans for addressing methane -particularly in regards to midstream and upstream oil and gas production?

Answer: On March 28, 2014 the Obama Administration released the Climate Action Plan: a Strategy to Reduce Methane Emissions. The strategy summarizes the sources of methane emissions, commits to new steps to cut emissions of this potent greenhouse gas, and outlines the Administration's efforts to improve the measurement of methane emissions. The strategy builds on progress to date and takes steps to further cut methane emissions from several sectors, including the oil and natural gas sector.

As one of those steps, EPA on April 15, 2014 released for external peer review five technical white papers on potentially significant sources of emissions in the oil and gas sector. The white papers focus on technical issues covering emissions and mitigation techniques that target methane and volatile organic compounds (VOCs). The peer review was completed June 16, 2014. As noted in the Obama Administration's Strategy to Reduce Methane Emissions, EPA will use the papers, along with the input we received from the peer reviewers and the public, to determine how to best address emissions from these sources.

This fall, EPA will determine what if any regulatory authorities, including setting standards under section 111 of the Clean Air Act or issuing Control Techniques Guidelines under section 182 of the Act, the agency will apply to emissions from these sources. If EPA determines to follow a regulatory course of action, it will undertake a schedule that will ensure that both rulemaking and any ensuing regulatory requirements for the states are completed by the end of 2016. The white papers as well as the peer review comments are available at: www.epa.gov/airquality/oilandgas/whitepapers.html

Another key step in the Obama Administration's Strategy to Reduce Methane Emissions, is the bolstering of EPA's voluntary Natural Gas STAR Program. The program has already identified more than 50 cost-effective technologies and practices that reduce or avoid methane emissions in the oil and natural gas sectors, by eliciting more robust industry commitments while

enhancing transparency and accountability. In the spring of 2014, EPA began to engage the industry, states, and other key stakeholders on ways to enhance this program, and will formally launch the new partnership by the end of 2014.

Environmental Health Claims

Question 23: EPA estimates that reductions in particulate matter (PM) will prevent 230,000 to 490,000 early deaths making PM exposure between the first to third highest risk factor for mortality in the U.S. in 2020. Will you commit to reviewing these analyses with the CDC and other health agencies to get support for these claims?

Answer: The EPA estimated that the Clean Air Act (CAA) Amendments of 1990 would prevent over 230,000 early deaths in 2020 with a 95th percentile confidence interval of 45,000 to 490,000 early deaths. Most of these early deaths are associated with reduced exposure to fine particles, including precursor pollutants such as sulfur dioxide that form fine particles in the atmosphere. These estimates are relative to a hypothetical baseline scenario without the 1990 Amendments and related programs. The EPA report received extensive review and input from the Council on Clean Air Compliance Analysis, an independent panel of distinguished economists, scientists and public health experts established by Congress in 1991.

The report is the third in a series of the EPA studies required under the 1990 Clean Air Act amendments that estimate the benefits and costs of the act. The reports are intended to provide Congress and the public with comprehensive, up-to-date, peer-reviewed information on the Clean Air Act's social benefits and costs, including improvements in human health, welfare, and ecological resources, as well as the impact of the act's provisions on the U.S. economy. More information and a copy of the report: http://www.epa.gov/air/sect812/prospective2.html

In addition, the peer-reviewed study, *The State of US Health, 1990-2010: Burden of Diseases, Injuries, and Risk Factors* concluded that ambient particulate matter pollution remains one of the top 10 health risk factors in the U.S. The study published in the Journal of the American Medical Association included co-authors from many health agencies. A copy of the study: http://jama.jamanetwork.com/article.aspx?articleid=1710486

New Source Performance Standards for Power Plants

Question 24: In a memo to the broader Science Advisory Board on Nov. 12, the SAB Work Group charged with reviewing the EPA's major rulemaking actions recommended a review of science underpinning the NSPS proposal. Specifically, the Work Group highlighted concerns that the underlying science lacked adequate peer review. Subsequently, at a SAB board meeting Dec. 4-5, the EPA representatives argued against the Work Group's recommendations. In light of these developments, we respectfully request that you make available to the Committee the following information:

- All written communications between those EPA employees the SAB or the SAB Work Group concerning peer review of any studies that the proposed standards relied

on.

Answer: With regard to your request for written communications, EPA staff informs me that the appropriate protocol is to make such a request through a separate letter to the agency. EPA will respond appropriately to any such request.

- A record of all peer review of any studies that the proposed standards relied on.

Answer: The EPA provided some additional information to SAB on the basis of the DOE NETL cost studies that the EPA used in developing the proposed rule and the peer review process followed by DOE NETL for that study. The DOE's robust process included outside input from knowledgeable stakeholders including industry, academia and government experts in the design of the study and a peer review of the final report by a wide range of similar experts. The documents provided to SAB are attached:
"FY05+NETL+Merit+Review+Final+Report+1217.pdf" and
"NETL+Review+comments+on+cost+&+Performance+fossil+EGU.pdf"

- EPA's intentions regarding the need for further peer review of any such studies and whether EPA intends to withdraw its reliance on any of those studies in promulgating the performance standards.

Answer: While the EPA did not conduct additional peer review of the DOE NETL cost studies, the different levels of multi-stakeholder technical input and final review meet the requirements to support the analyses as defined by the EPA Peer Review Handbook.

After consideration of the clarifying information and thorough discussion about the issues during several meetings of the SAB that were open to the public, the workgroup recommended to the full SAB that additional review of the science of sequestration was not necessary in the proposed Carbon Pollution Standard. The full SAB agreed with the workgroup's assessment that the proposed Carbon Pollution Standards rely on existing requirements for sequestration and that peer review of the DOE cost studies was sufficient. In a memo dated January 29, 2014, the SAB informed the EPA that it will not undertake further review of the science supporting this action.

- All records of any SAB or the SAB Work Group review of or input into the proposed standards. If EPA did not solicit this input, please explain why not.

Answer: The SAB convened a Work Group to consider the science supporting actions identified in the Spring 2013 Unified (Regulatory) Agenda and Regulatory Plan and requested the Work Group to provide the SAB with a report on these considerations. As part of that activity the Work Group and the SAB considered whether to review the science supporting any of the planned regulatory actions in that agenda in order to provide advice and comment on the adequacy of the science, as authorized by section (c) of the Environmental Research, Development and Demonstration Authorization Act. This activity included

consideration of the Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units (2060-AQ91).

With regard to your request for records, EPA staff informs me that the appropriate protocol is to make such a request through a separate letter to the agency. EPA will respond appropriately to any such request.

- EPA's intentions regarding future SAB or SAB Work Group input into the proposed standards. If EPA does not intend to solicit this input, please explain why not.

Answer: As noted above, the full SAB agreed with the workgroup's assessment that the proposed Carbon Pollution Standards rely on existing requirements for sequestration and that peer review of the DOE cost studies was sufficient. In a memo dated January 29, 2014, the SAB informed the EPA that it will not undertake further review of the science supporting this action.
With respect to the existing geologic sequestration regulations, the EPA will continue to monitor technological progress on geologic sequestration as those regulations, which contain specific monitoring and operational requirements, are implemented. The EPA also will continue to work with other agencies, researchers, and industry to ensure that our regulations are based on the best available science. The EPA plans to provide a briefing on these activities and periodically update the SAB on the status of its geologic sequestration regulations, ongoing permitting, and collaboration with DOE and other agencies.

- All records of any SAB or SAB Work Group input into EPA's development of regulations under Section 111(d) of the Clean Air Act pertaining to existing fossil-fuel-fired electric generating units or SAB or SAB Work Group consideration of such regulations.

Answer: The SAB did not provide advice or comment to the EPA for the development of a proposed rule for the Greenhouse Gas Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (2060-AR33). The SAB convened a Work Group to consider the science supporting actions identified in the Spring 2013 Unified (Regulatory) Agenda and Regulatory Plan and provide the SAB with a report on these considerations. As part of that advisory activity the Work Group and the SAB considered whether to review the science supporting any of the planned regulatory actions in that agenda in order to provide advice and comment on the adequacy of the science, as authorized by section (c) of the Environmental Research, Development and Demonstration Authorization Act. This activity included consideration of the Greenhouse Gas Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (2060-AR33). With regard to your request for records, EPA staff informs me that the appropriate protocol is to make such a request through a separate letter to the agency. EPA will respond appropriately to any such request.

- EPA's intentions regarding future SAB or SAB Work Group input into these existing unit regulations. If EPA does not intend to solicit this input, please explain why not.

Answer: The EPA has engaged in, and continues its engagement with a broad range of stakeholders about the proposed Clean Power Plan to ensure it is informed by a full range of perspectives, technical information and other information relevant to the proposal. . EPA recently informed the SAB of this rule and the Agency's technical approach and the SAB determined that the science supporting this action did not require further peer review.

Question 25: Since EPA claims no one is expected to build a new coal plant in the near future, could EPA wait 8 years until the next review of NSPS to allow greater time for determination as to whether CCS is adequately demonstrated for new coal plants? If so, why does EPA see the need to determine whether CCS is adequately demonstrated before this time, seeing as no NGU's will be built before then?

Answer: The EPA is setting a source category limit as authorized by CAA Sec 111(b). The CAA requires the EPA to identify the "best system of emission reduction ... adequately demonstrated" (BSER) available to limit pollution – and set an emission standard based on that analysis. After analyzing the factors that make up BSER, we proposed to determine that partial CCS is the BSER for new coal-fired EGUs. As discussed in the preamble for the proposed rule, 79 FR at 1462, the Act and subsequent court decisions identify factors for the EPA to consider in a BSER determination including: (1) the technical feasibility, (2) the reasonableness of the costs, (3) the promotion of advanced technology, and (4) the size of emission reductions. After reviewing many reports, studies, projects, and stakeholder input EPA proposed to determined partial capture of CO2 best meets the requirements for BSER and is consistent with a number of projects currently under development. When finalized, the proposed standards will provide those generators that may choose to build new coal-fired capacity with certainty as to the facilities GHG obligations.

Economic Modeling Commitment

Question 26: Since 1977, section 321 (a) of the Clean Air Act (CAA) has required "the Administrator to conduct continuing evaluations of potential loss of shifts of employment which may result from the administration or enforcement of the provision of [the Clean Air Act] and applicable implementation plans, including where appropriate, investigating threatened plant closures or reductions in employment allegedly resulting from such administration or enforcement." The #321 requirement is different than the requirement from Executive Order 12866 that EPA consider in a Regulatory Impact Analysis (RIA) what impact a single proposed rule will likely have on jobs. For S321, EPA has to consider the impact that existing CAA requirements – taken as a whole- have had on job losses and shifts in employment throughout our economy. RIA's, by contrast, only consider the potential future employment impact that a single proposed rule will have. Therefore, EPA's preparation of RIA's for new rules does not satisfy S321 (a). EPA has never conducted a section 321 (a) study to consider the impact of CAA programs on jobs and shifts in employment.

Why has EPA not conducted a study to consider the impact of CAA programs on job shifts and in employment?

Will EPA commit to conducting such studies in the future?

Answer: The EPA has found no records to indicate that CAA section 321, since its inclusion in the 1977 amendments, has been interpreted by any Administration to require job impacts analysis of rulemakings or job impacts analysis of existing CAA requirements as a whole. Section 321 does provide a mechanism for the EPA investigation of particular claims of job loss related to plant closure or layoffs in response to environmental regulation or enforcement actions. In addition, the EPA performs detailed regulatory impact analyses (RIAs) for each major rule it issues, including cost-benefit analysis, various types of economic impacts analysis, and analysis of any significant small business impacts. Since 2009, the EPA has focused increased attention on consideration and (where data and methods permit) assessment of potential employment effects as part of the detailed RIAs conducted for each major rule. EPA has found that existing methods for assessing employment effects of economically significant regulations have significant limitations and weaknesses, and has been transparent about these limitations and weaknesses as it has explored alternate approaches for better understanding these effects. With this caveat, the EPA analyses, consistent with current literature, have generally found that environmental regulations may have both positive and negative effects on jobs but that these effects tend to be relatively small and difficult to quantify with any precision. This is consistent with data from the Bureau of Labor Statistics that indicate labor markets are primarily influenced by other, larger factors including routine business cycles, changes in production technology, and the state of the overall economy. Nevertheless, the EPA continues to explore and evaluate potential tools, data, and methodologies that could expand and improve assessments of the effects of our programs, including effects on labor markets. We will continue to comply with statutory and administrative requirements for analysis of our programs in a manner consistent with principles of sound science and economics.

Question 27: EPA committed to convene an independent panel of economic experts experienced with "whole-economy" modeling to evaluate whether EPA's current economic modeling adequately measures the employment impacts of rules. Why has the EPA not convened such an independent panel? Does EPA have plans of convening this panel in the future? If so, when?

Answer: Last year, Acting Administrator Perciasepe sent a memo to the EPA's Science Advisory Board (SAB) Office asking it to convene a new expert panel on economy-wide modeling. Following typical procedures for this type of panel, EPA's Office of Policy and Office of Air and Radiation released a set of draft charge questions and an analytic blueprint for public comment in February 2014. The comment period closed on April 7, 2014. The SAB Office recently published a Federal Register Notice soliciting nominations of experts for the panel, which closed on May 21, 2014. The list of candidates was posted on the SAB website on

July 7, 2014 for comment, and EPA expects that the SAB Office will be able to formally convene a panel by Fall of 2014."

Sue and Settle

Question 28: During Senate confirmation as EPA Administrator on July 9, 2013, you agreed to undertake four actions items: (1) improve Freedom of Information Act (FOIA) training for EPA employees, (2) publicly release the scientific information EPA used to set nationwide air quality standards, (3) study whether EPA needs to conduct more through economic analyses of the employment impacts of its regulations, and (4) to publish on two websites the Notices of Intent to Sue (NOIs) and Petitions for Rulemaking (PFRs) received by the agency.

- What steps have you taken since your confirmation to improve the transparency of this process and allow affected parties, including states and industry, to participate in the process, including settlement negotiations, to ensure that all interests are represented?

- As EPA Administrator, what steps are you taking to ensure that the agency does not agree to deadlines through settlements that do not provide sufficient time for EPA to meet its obligations under the Administrative Procedure Act, the Regulatory Flexibility Act, the Small Business Regulatory Enforcement Fairness Act, OMB Circular A-4, and other requirements that apply to EPA?

Answer: The EPA has made a concerted effort to provide additional information to stakeholders, and to seek input widely on EPA actions. For example, as the Agency works to develop the proposed carbon pollution standards for existing power plants, the process of engagement with states, stakeholders, and the public has been extensive, and stakeholders all over the country have taken advantage of the opportunities provided.

With respect specifically to lawsuits, the EPA has continued to expand its website providing Notices of Intent to Sue, and has begun posting copies of complaints when one associated with a posted notice is filed. http://epa.gov/ogc/noi.html.

Most of the EPA settlements are under the Clean Air Act; most of these agreements are published in the Federal Register for public comment, and all comments are considered before the agreement is finalized.

The EPA does not and will not commit in any settlement agreement to any final, substantive outcome in a rulemaking or other decision-making process. The EPA settlements do not impair notice-and-comment rulemaking rights. In any settlement, it is the EPA's priority to secure enough time to allow for an appropriate decision-making process, including appropriate public input and participation. All interested parties are provided opportunities for comment on proposed rules, and comments submitted are carefully considered and often significantly shape the final rule.

Question 29: In a denial earlier this year of several environmental groups' petition for a rulemaking under the Clean Air Act, Acting Administrator Robert Perciasepe stated that, "[e]ven under the best circumstances, the EPA cannot undertake simultaneously all actions related to clearly determined priorities as well as those requested by the public, and so the agency must afford precedence to certain actions while deferring others... The EPA must prioritize its undertakings to efficiently use its remaining resources."

In your view, do new commitments that EPA agrees to in "sue and settle" agreements with environmental groups, including timetables for rulemaking, have an impact on EPA's priorities as to the rulemakings that it undertakes? Have they had an impact on EPA's budgetary resources?

Answer: The EPA is frequently sued by stakeholders, including industry, environmental groups, and state and local governments. Litigation is adversarial by nature: It is never EPA's preference to be sued, and the Agency is not complicit in such lawsuits. While the EPA litigates most of these suits to final judgment, the EPA, much like its sister agencies throughout the Federal Government, has a longstanding practice of entering into settlements in lieu of resource-intensive litigation where, in the judgment of the Agency and its representatives at the United States Department of Justice (DOJ), it would be in the interest of the Agency and in the interest of the public to pursue settlement. Each settlement agreement is the result of a negotiation between opposing parties, with DOJ representing the EPA and the interests of the United States.

Litigation can certainly be expensive, and as such can have an impact on the EPA's resources. Settlements, however, generally save the Agency (and the taxpayer) money.

The large majority of the EPA settlements occur in cases where the complaint alleges the EPA has failed to meet a mandatory duty it is obligated to perform under federal law. In well-grounded mandatory duty lawsuits, seeking settlement is the most responsible course of action. The alternative would involve engaging in expensive litigation with the expected outcome of a court-ordered schedule likely to require agency action on a less feasible timeline, with an increased risk of higher fees and costs.

Tier 3

Question 30: Did EPA proceed with the Tier 3 rule to satisfy an agreement during the CAFÉ negotiations?

Answer: No.

Integrated Risk Information System

Question 31: IRIS assessments released at the evidence table stage come without context

and the public lacks knowledge regarding EPA thoughts regarding endpoints of concern, modeling and critical literature. As such, within just 60 days, the public must review hundreds of studies to provide comments to EPA on their quality, acceptability and suggested use. This may be placing a heavy burden on stakeholders who wish to engage the EPA. Do you believe changes could be made to this approach that might benefit stakeholders? If so, what changes do you think stakeholders might benefit from most?

Answer: Stakeholder engagement is very important to the IRIS Program, and the EPA was responsive to stakeholder suggestions in designing enhancements to the IRIS Program (announced in July 2013). Small adjustments may become necessary as we move forward to implement the enhancements. For example, in December 2013, we held our first IRIS bimonthly public meeting to discuss: 1) early materials (literature search, evidence tables, and exposure-response figures) for chemicals being assessed through the IRIS Program; and 2) draft assessments and draft peer review charges. In response to comments heard at the December bimonthly public meeting, we are providing information to all stakeholders that will make it possible for anyone to participate early in the assessment development process, prior to IRIS Program decisions regarding hazard identification and dose-response assessment. Some specific changes in our approach, designed to better facilitate participation and discussion, are already occurring through changes to our IRIS bimonthly public meetings and preliminary material releases (e.g., diethyl phthalate and hexabromocyclododecane). These improvements have been recently announced on the IRIS website (www.epa.gov/iris) and include the following additional materials:

- Sections of the assessment on scope and problem formulation that explains why EPA is interested in conducting an assessment and provides some background information on the chemical, its predominant uses, and the pathways through which humans can be exposed.
- The initial literature search strategy and the results of the literature search.
- Evidence tables that summarize key information on the design and results of pertinent scientific studies. Studies with serious flaws according to criteria discussed in the EPA's guidelines (and summarized in the draft Preamble to the IRIS Toxicological Review) are excluded. If additional selection criteria were applied to facilitate a more efficient review of the evidence (for example, to highlight the most informative studies when there are a large number of studies on an effect), these criteria are explained in text accompanying the evidence tables.
- Some key science issues that will be considered in the development of future assessments.

As the IRIS program continues to evolve, the EPA is committed to evaluating how well our approaches promote constructive public discussion with our stakeholders as well as reviewing how our approaches can more effectively facilitate subsequent assessment development.

Question 32: EPA has released a complete draft benzo[a]pyrene assessment for 60 day

peer review. Upon request, EPA did extend the comment period for another 30 days. However, the document and supporting information is over 500 pages and the public did not benefit from any review of evidence tables. There were no earlier discussions with EPA about critical studies. Why didn't EPA share some of the preliminary information with the public before releasing a completed draft assessment?

Answer: When the IRIS Program announced the enhancements in July 2013, there were IRIS assessments in different stages of development. For example, some assessments were in the early stages of development, some were nearly ready to publicly release in draft form, and some were in the latter stages of development. Therefore, the degree to which the enhancements are being applied for a particular assessment varies and depends on the step an assessment was in when the IRIS enhancements were announced. The draft benzo[a]pyrene assessment was nearly complete when we announced the enhancements to the IRIS Program in July 2013 – thus, we released the draft assessment for public comment in August 2013. During the December 2013 IRIS bimonthly public meeting, we had a robust discussion with stakeholders about the draft benzo[a]pyrene assessment. We are revising the draft assessment based on the public comments we received and the discussion we had during the December meeting. We will release a revised draft assessment for peer review in the near future.

Question 33: Will you ensure that as part of the improvements in the IRIS program, the Agency will move away from outdated default assumptions and instead always start with an evaluation of the data and use modern knowledge of mode of action – how chemicals cause toxicity – instead of defaults?

Answer: In developing an IRIS assessment, the EPA looks at all of the available data, including information about mode of action. We look at the entire database of scientific information, and we systematically review that information to develop the assessment. For example, consistent with the Agency's *Guidelines for Carcinogen Risk Assessment*, the EPA considers a critical analysis of all relevant information as the starting point from which a default option may be invoked if needed to address uncertainty or the absence of critical information. Examples of the EPA's other guidelines that include information on default approaches include the Benchmark Dose Technical Guidance (US EPA, 2012) document and the Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (US EPA, 2005). These guidelines and others are available at http://www.epa.gov/iris/backgrd.html. The EPA is committed to using sound science and continues to make significant progress in developing data-derived approaches and mechanistic models that require more detailed databases. While committed to these efforts whenever possible, in the absence of data, the Agency relies on scientifically-based and health protective default approaches, consistent with Agency policies and guidelines.

Question 34: To further improve the IRIS Program, can you commit to revising the way hazard values are presented to the public to ensure that critical science policy assumptions are transparency presented and not comingled with scientific assumptions?

Answer: Yes, the EPA is committed to making sure that the scientific foundation for our decisions reflects the best possible science and that information is communicated in a transparent manner.

Question 35: What are natural environmental chemical levels? What are background, man-made chemical levels? How do you consider these levels in IRIS determinations? How do IRIS hazard values accommodate levels associated with existing natural exposures that are not known to be associated with any adverse effects at these low exposure levels?

Answer: Scientists commonly use the term "background levels" to mean three different things: (1) levels of chemical compounds that are produced within the body ("endogenous" compounds), (2) levels of substances that are in the environment from natural sources and processes (one might call these "naturally-occurring"), and (3) whatever concentrations occur from sources other than the source being considered in a decision, including sources due to human actions.

IRIS assessments are developed to provide information on the health effects associated with exposure to chemicals from sources over which the EPA has regulatory authority, including some chemicals that occur naturally in the environment at some level or are produced endogenously. IRIS values generally already take into account amounts commonly produced by our own bodies ("endogenous exposures"). The fact that a chemical is naturally produced does not make it "safe" at all doses; there are many natural products of metabolism that can have toxic effects at high enough levels. In addition, in the risk assessment paradigm, noncancer hazards and increased cancer risks are generally based on comparisons to unexposed populations. The adverse effects of hazardous agents are not driven by whether or not they are "naturally" occurring. The source of the exposure does not impact the dose at which an adverse effect is observed. Natural occurrence and background levels are more appropriately considered in the risk management strategy.

Question 36: Can you commit to ensuring that a 3rd party, independent of the IRIS Program, is tasked with ensuring that EPA staff have sufficiently considered and responded to peer reviewer and public input before assessments and other documents are finalized?

Answer: Following external peer review, the EPA revises draft assessments to respond to public and peer review comments. The revised draft is then reviewed by Agency scientists who do not work in the IRIS Program; additionally, it is reviewed by scientists from other federal agencies and the Executive Office of the President. The EPA's responses to public and peer review comments are documented in an appendix to each IRIS assessment.

Cross-Cutting Risk Assessment Concerns

Question 37: Some scientists have suggested using a weight of evidence framework that incorporates relevant and reliable data along with knowledge of hypothesized modes of action, so that there is a clear and objective presentation of the extent to which existing data and knowledge do, or do not, support each hypothesis, including the default. Do you support such an approach? If so, can you provide us with a timeline for such an approach that might be adopted within OPPT and IRIS?

Answer: Hazard identification involves integrating evidence from human, animal, and mechanistic studies to draw conclusions about a chemical's hazards. In general, IRIS assessments integrate evidence consistent with a framework developed by Sir Bradford Hill, which outlines aspects (for example, consistency, strength, biological plausibility, etc.) for considering causality in epidemiologic investigations. These were later modified and extended to experimental studies. The IRIS Program currently uses existing methodology (i.e. the 2005 Cancer Guidelines, and the 2002 Technical Report on the RfD/RfC Process) built upon the Hill criteria, to inform assessments. The IRIS Program is working toward adopting systematic review methods (for selecting and analyzing studies) and data integration or weight-of-evidence approaches (to develop overall findings). To move forward in this area, in August 2013, the EPA convened a public scientific workshop focused on approaches for evaluating individual studies, synthesizing evidence within a particular discipline, and integrating evidence across different disciplines to draw scientific conclusions and causality determinations.

The IRIS Program is committed to systematic review and weight of evidence approaches in developing assessments, including consideration of studies with positive and negative findings, and is moving forward in that area.

OPPT supports the IRIS program's approach to weight of evidence, and where available and appropriate incorporates information from IRIS into OPPT assessments. When OPPT does so, the weight-of-the-evidence considerations of the IRIS assessment are brought into the OPPT assessment in a manner consistent with the scoping of the OPPT assessment. OPPT typically assesses chemicals for which there is much less information than exists with chemicals for which IRIS assessments are conducted. As a result, the weight-of-evidence considerations for OPPT assessments that rely on relatively little data are considerably more limited, and case-specific, than those used for IRIS assessments that may have robust data sets.

Question 38: One of the biggest challenges for risk assessment is the insistence by some international regulators to use hazard as a surrogate for risk in regulatory decision-making. When EPA personnel participate in international forums where these issues are being discussed (e.g., OECD, APEC, SAICM, etc.) will you encourage them to advocate that risk be

used as the basis for human health and environmental policy development?

Answer: Yes. For example, the IRIS Program identifies the quantitative dose-response information useful for risk assessment whenever that information exists. As such, it strongly supports the ability of regulatory and other programs to base their decisions upon estimates of risk, not just hazard.
Most of the environmental statutes passed by Congress incorporate the consideration of risk into environmental decision-making within the United States. Given that, I expect that EPA personnel participating in international forums where these issues are being discussed will encourage the use of risk-based decision making.

Question 39: EPA's IRIS program completes no more than 10 assessments per year. Since 1999 the Canadian government has evaluated about 23,000 chemicals as part of its chemical management plan. By 2006, all 23,000 chemicals had been evaluated and about 4,000 chemicals were identified as requiring further review. Since then Canada has been systematically reviewing these 4,000 substances and has thus far identified a list of Priority Substances considered "toxic" under the criteria laid out in legislation for which management plans are to be created.

- Does EPA have the capacity to review the same number of chemicals in the same time period as the Canadian government?
- What did the Canadian government find that disagrees with EPA findings?
- What is EPA doing to streamline the chemical assessment process?
- Would you agree that the IRIS program can do better, and that some fundamental changes are necessary?
- What changes do you believe should be made to the IRIS program?
- Do you support broad discussions with stakeholders to re-think the IRIS framework and approach?

Answer: The efforts of the Canadian government discussed above related to chemical screening and prioritization. To our knowledge Health Canada identified a much smaller subset of the 23,000 chemicals as requiring a full assessment. We are not aware of any disagreements that EPA may have had with the initiatives or findings of the Canadian government. EPA has a number of activities focused on developing new methodologies to screen the large number of chemicals in commerce and the environment. For example, EPA has an active computational toxicology effort in its Office of Research and Development, through the Chemical Safety for Sustainability research program, that uses rapid, automated tests called "high-throughput screening assays." The computational toxicology effort is also developing high-throughput exposure predictions with the goal to generate higher throughput risk-based evaluations. To date, this effort has screened 1,800 chemicals in over 700 high-throughput assays. The EPA's endocrine disruption screening program has already started the scientific review process to use these new high-throughput screening assay data to prioritize chemicals for potential endocrine-related activity.

In September, 2013 the EPA researchers released the draft report *Next Generation Risk Assessment: Incorporation of Recent Advances in Molecular, Computational, and Systems Biology* which begins to address how the EPA can take full advantage of novel data sources in its risk assessments. In the next phase of this effort, the EPA will enter novel data streams generated by ToxCast and related research will be used to enhance and accelerate the EPA's risk-based chemical evaluations.

The EPA ORD now has a research collaboration with Health Canada to determine if the high-throughput chemical data the EPA generates through ToxCast can be used to inform decisions made about the chemicals listed in their Chemical Management Plans. This collaboration as well as others with European chemical and health agencies will help accelerate the EPA's own risk assessments in the coming years.

Regarding your questions about the IRIS Program, in July 2013, after extensive outreach and conversations with Agency partners and external stakeholders, the EPA announced changes to the IRIS Program to: 1) improve the science of assessments; 2) improve the productivity of the Program; and 3) increase transparency so issues are identified and debated early in the process. Since that time the IRIS Program is continuing to evolve, incorporating recommendations from the 2011 and 2014 NRC reports related to IRIS. As part of the changes to the IRIS Program, we are continuing our efforts in stakeholder engagement (including discussion of science and process issues) at bimonthly public science meetings where ongoing assessments are discussed. EPA anticipates that this early engagement will result in identifying issues early in the process so the pace of assessments is not slowed down by scientific controversies later on. We are also strengthening our peer review process through the use of the Science Advisory Board's Chemical Assessment Advisory Committee. We believe that, over time, these changes will increase the efficiency with which the EPA produces the in-depth reviews for which IRIS is known and respected.

Questions Regarding ORD Nominee Thomas Burke

Question 40: Thomas Burke suggested in an NAS report he chaired that information on nonchemical stressors should be incorporated into assessments and EPA should further research dollars into evaluating the interactions between chemical and nonchemical stressors.

- Do you believe that EPA has the staff, with requisite qualifications, and financial capacity to also take on evaluations of nonchemical stressors?
- Should EPA convince Congress, NAS, and all other stakeholders that they can appropriately evaluate chemical stressors before broadening their scope to include evaluation of chemical stressors?

Answer: In 2003, the EPA published the Framework for Cumulative Risk Assessment and where helpful in decision making, the EPA has assessed risks of multiple chemicals. This is an important and evolving area of science, and multiple advisory groups, such as the National

Academy of Sciences and the National Environmental Justice Advisory Committee, have urged the EPA to incorporate information about nonchemical stressors into assessments of chemicals, such as those developed through the Integrated Risk Information System (IRIS) Program. At this point, it would be difficult to routinely incorporate nonchemical stressors into chemical assessments given existing resources. However, because it is an important area of science, the EPA is funding research to increase understanding of the role of nonchemical stressors in cumulative risk assessments, including seven Science to Achieve Results (STAR) grants specifically examining the role of nonchemical stressors in cumulative risk assessment.

In addition to research on methodologies, the EPA has Technical Panels established to develop guidance on how to approach cumulative risk assessments that include chemical and non-chemical stressors. These efforts are directly related to recommendations from multiple reports from the National Academy of Sciences.

Grant Funding – Conflict of Interests

Question 41: In response to questions you stated that you have a process in place to review the eligibility of EPA grant recipients serving on peer review panels. When was this review process put into place?

Answer: The EPA has processes in place to identify potential conflicts of interest for persons (including EPA grant recipients) who may serve on peer review panels. The EPA also monitors its processes for areas of improvement. For example, in March 2013, the EPA strengthened its oversight of contractor-managed peer review panels for influential scientific and technical documents. The new oversight includes additional steps which increase transparency by allowing for a public review and comment period on potential panelists. For more information on the process, you may visit (http://www.epa.gov/osa/pdfs/epa-process-for-contractor.pdf) and http://www.epa.gov/peerreview/pdfs/peer_review_handbook_2012.pdf.

Question 42: Did EPA review in detail the grants that were obtained by current CASAC panel members and consultants to determine if there was a potential conflict?

- If so, who within EPA conducted this review?
- What does the grant review involve?
- Are the grants to the potential member's institution also reviewed?
- Can EPA share the results of this grant review with the Committee?

Answer: Yes, the SAB Ethics Officer conducted an initial review followed by a final review by the SAB Office Director, who is the Deputy Ethics Official. The grants awarded to a candidate are reviewed as part of the full review of the information provided on the confidential financial disclosure form, the EPA Form 3110-48. The SAB Staff follows the approach identified in the OMB Bulletin (p.25): "Research grants that were awarded to the scientist

based on investigator-initiated, competitive, peer reviewed proposals do not generally raise issues of independence. However, significant consulting and contractual relationships with the agency may raise issues of independence or conflict, depending upon the situation." The EPA reviews candidate's grants to ensure that they have no financial conflicts of interest, as defined by 18 U.S.C. §208 and to ensure, consistent with the EPA's Peer Review Policy, that experts will not peer review their own work. Consistent with this latter point, the scope of grants is evaluated to determine whether products developed under any grant are to be peer reviewed by a panel. Grants to a potential member's institution are not reviewed unless the grants are reported on the EPA Form 3110-48 as sources of research or project funding received by the potential member or his or her spouse in the last two years. The EPA cannot share the results of the grant review because the information reported on the confidential financial disclosure form, the EPA Form 3110-48, is deemed confidential under 5 CFR 2634.901(d). Information on recipients of the EPA grant funding are available in the public domain at http://yosemite.epa.gov/oarm/igms_egf.nsf/recipient2?OpenView. Information about the results of the EPA's ethics review is included in the Determination Memoranda posted to the CASAC website (www.epa.gov/casac) for each CASAC panel or committee established by the EPA.

- If EPA has not done the detailed review of the individual grants of CASAC panel members and consultants, why not? When will EPA conduct this review?

Answer: The grants awarded to a candidate are reviewed as part of the full review of the information provided on the confidential financial disclosure form. A review of various factors such as employment, expert testimony, grants and contracts, assets and public comments are considered and reviewed prior to each new advisory activity to determine a candidate's eligibility to participate on a panel. This process was followed for CASAC panel members and consultants.

- Under what specific circumstances would EPA conclude that a grant recipient should not serve on a peer review panel?

Answer: A candidate who has any financial or other interest that conflict with the service of the review panel would not be eligible to participate on that particular review panel. With regard to grants, the scope of grants awarded to a candidate is evaluated to determine whether products developed under any grant are to be peer reviewed by the panel.

Question 43: When EPA appointed Dr. Jonathan Samet to be chair of the CASAC panel reviewing the PM2.5 NAAQS, did EPA review EPA grants to Dr. Samet and his affiliated research institutions for a potential conflict?

Answer: Yes. Grants awarded to candidates for CASAC panels are evaluated to determine whether products developed under such grants include products that will be peer reviewed by the panel. However, as noted in guidance from the Office of Management and Budget, "when an agency awards grants through a competitive process that includes peer review, the agency's potential to influence the scientist's research is limited. As such, when a

scientist is awarded a government research grant through an investigator-initiated, peer reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects" (OMB's Final Information Quality Bulletin for Peer Review, December 16, 2004).

- How far back did the evaluation go?

Answer: The Confidential Financial Disclosure Form (EPA 3110-48) asks candidates to disclose any source of research or project funding received in the last two years preceding the date of filing.

- What was the total amount of the EPA funding provided to Dr. Samet and his research institutions in the five years leading up to his appointment?

Answer: Prior to his appointment as Chair of the CASAC PM Panel in 2008, Dr. Samet submitted the Confidential Financial Disclosure Form (EPA Form 3110-48). In accordance with instructions on the form, Dr. Samet listed sources of research or project funding received in the last two years preceding the date of filing. The EPA did not develop a total for the EPA funding provided to Dr. Samet or to his research institution in the five years preceding his appointment as Chair of the CASAC.

- If EPA grants were provided, what areas of research did the grant funding cover?

Answer: Dr. Samet reported an EPA grant focused on the physical and chemical characteristics of particulate matter (PM) that determine risk to human health, and EPA funding to support a workshop and report on the use of statistical models for low dose-response data extrapolation in environmental health risk assessments..

- Did any of the grants address PM2.5 or ozone NAAQS related science?

Answer: As noted in the previous response, Dr. Samet reported the EPA grant funding related to the health effects of exposure to fine PM. Dr. Samet was not asked to and did not review the results of any of his research funded by grants from the EPA.

Question 44: EPA's Peer Review Handbook states that experts that have made public pronouncements on an issue may lack impartiality and should be avoided; and that individuals who have "taken sides" should be avoided. According to the recently released IG Report on EPA's management of CASAC, in 2008, EPA selected Jonathan Samet as Chair of CASAC to review the PM2.5 standard even though he had published an article in 2006 opposing EPA's current PM standard. The IG Report stated that Dr. Samet failed to disclose the public statement in the disclosure form that specifically asked if he "made any public statements, written or oral, on the issue that would indicate to an observer that you have taken a position on the issue under consideration." According to the IG Report, CASAC members are also required to update this form annually and to participate in an ethics training course.

- Did the SAB staff review Dr. Samet's publications to see if a public statement had

been made?

Answer: Yes.

- Has anyone at EPA asked Dr. Samet why he omitted this important information despite a direction question on his form?

Answer: Dr. Samet provided disclosure of his public statement. In 2006, the Confidential Financial Disclosure Form (EPA Form 3110-48) did not request information on public statements. However, Dr. Samet did disclose his 2006 editorial in the *American Journal of Respiratory and Critical Care Medicine* in an e-mail to Designated Federal Officer Fred Butterfield dated 1-31-06 in direct response to a question about past public statements.

- Did Dr. Samet submit a new financial disclosure statement annually while Chair? If so, did he continually omit disclosure of his public statements on all his forms?

Answer: Yes, Dr. Samet submitted new financial disclosures on a yearly basis. His disclosures included public statements.

Question 45: Does EPA normally review publications of CASAC members and consultants to determine if public statements have been made?

Answer: Yes, this is part of our standard protocol.

Data Transparency

Question 46: In answering member questions, you stated that in response to the Shelby Amendment on data access, you have assured yourself that you have access to the underlying research data. Does this include the confidential cohort data?

Answer: The EPA has assured that the Agency has received from researchers and transmitted to Congress the research data that the Agency has determined are required to be provided under the Shelby Amendment, consistent with applicable protections for private medical and similar information. The EPA does not have access to much of the underlying data requested by Congress because that information is held solely by the outside research institutions that conducted these large-scale epidemiological studies, not the EPA.

Question 47: Given that the American Cancer Society and Harvard Six City studies were funded by the EPA, does the federal government have the ability to obtain the data that resulted from those grants under 36(c)(1)&(2) of the A-110 Circular?

Answer: The American Cancer Society studies were not funded by the EPA and, accordingly, the Agency does not possess or have access to data held solely by the outside research institution. With respect to the Harvard Six City studies, the EPA has already provided Congress the research data that the Agency has determined are subject to the Shelby Amendment.

Question 48: Can you provide us with a list of all the times EPA has obtained research data to conduct its own analysis?

Answer: The EPA conducts research and analyses on many topics in order to fulfill its mission to protect human health and the environment, and data collection for those studies and analyses occurs continually. Given the many instances of when this occurs, the EPA does not maintain a list of all the times the Agency obtains research data to conduct its own analysis. The EPA follows all applicable laws and regulations to protect private medical and similar information.

Question 49: Are there studies on PM2.5 and ozone studies that rely on publically available data sets? If so, please list those studies.

Answer: There are many studies across the scientific disciplines that use publicly available data sets that are included in the Integrated Science Assessments (ISAs) for ozone and particulate matter (ozone – http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=247492, and PM – http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=216546) The EPA maintains a comprehensive list of all studies included in these assessments in its publicly available Health & Environmental Research Online (HERO) database (http://hero.epa.gov/). Ozone (http://hero.epa.gov/index.cfm/project/page/project_id/1628); PM (http://hero.epa.gov/index.cfm/project/page/project_id/15) In many studies, however, scientific protocols require that authors not publicly report underlying data pertaining to personal medical information to protect the privacy of study participants. The EPA understands that it is important to increase transparency and public access to information, but it is also essential to protect the privacy of individuals who have served as subjects in studies along with their personal health information.

Question 50: Will EPA commit to not rely on studies for setting standards that are based on underlying data sets and methodologies that neither EPA nor the public can access and review?

Answer: The EPA is committed to transparency with regard to the scientific bases of agency decision making. The use of personal medical information does not in any way undermine the validity of the studies' results, nor does it call into question the EPA's reliance on those studies, along with thousands of other peer-reviewed studies, when the agency considers the scientific foundation for NAAQS and similar science-informed determinations, including decisions regarding methods used in risk and benefit assessments.

Questions Relating to the Use of Old Cohort Data

Question 51: The individual cohort data from the American Cancer Society and Harvard University are over 30 years old. Because the data were collected over 30 years ago, the smoking rates of the individuals in the studies have stayed the same despite a dramatic fall in smoking nationally. Similarly, the assumptions about participants' use of heart medicine and cholesterol lowering drugs have not changed over these 30 years, despite

the dramatic increases in their usage nationally.

- Does EPA believe that the outdated nature of the individual cohort data used in studies that rely on the ACS and Harvard Six City cohort data create additional uncertainties and weaknesses that could be corrected if new cohort data were used?

- Does EPA believe that the small but statistically significant decrease in deaths attributed to reduced PM2.5 exposures in these studies are, at least in part, due to reductions in smoking or increased use of medications that the studies are not addressing? If so, how can the EPA know what percent of the decrease in deaths attributed to reduced PM2.5 exposures are actually due to other factors?

Answer: The EPA considers studies based on the American Cancer Society and Harvard Six Cities cohorts as part of the full body of science on air pollution and health in establishing National Ambient Air Quality Standards (NAAQS) and in assessing the health impacts of other major rules. In the process of establishing a NAAQS, the EPA looks comprehensively at the available science, assessing thousands of scientific studies using all of the appropriate peer-review processes and guidance. For example, in the most recent PM NAAQS integrated science assessment the EPA cited approximately 2,000 peer-reviewed studies.

During the most recent review of the PM NAAQS, the EPA examined studies of newer cohorts that confirmed that premature death is associated with fine particle pollution, in some cases at pollution levels lower than those reported in studies of the American Cancer Society and Harvard Six Cities cohorts. Additionally, some of these studies based on newer cohorts showed even greater risks of premature mortality than studies of either the American Cancer Society or Harvard Six Cities cohorts.

In developing methods to use in regulatory impact analyses for major rules, the EPA evaluates a variety of long-term cohort studies, including newer cohort studies. The EPA includes an assessment of the strengths and limitations of each study to determine the most appropriate studies to use in estimating risks and health effects avoided. On balance, studies of the American Cancer Society and Harvard Six Cities cohorts follow groups of participants that are more representative of American populations in terms of age, gender, and geography than other cohorts used in currently available studies. In addition, studies conducted using these cohorts include extended follow-up analyses that capture longer-term health impacts better than other studies without long follow-up periods.

Environmental Research, Development and Demonstration Authorization Act

Question 52: The Environmental Research, Development and Demonstration Authorization Act of 1978, 42USC #4365 (ERDDAA) established the Science Advisory Board (SAB).

a. Please explain in detail how you interpret the provisions ERDDAA.

Answer: The Science Advisory Board (SAB) was established by the EPA Administrator in January 1974. Section 8 of the Environmental Research, Development and Demonstration Authorization Act of 1978 (ERDDAA), 42 USC § 4365, provided statutory authority for the SAB. The SAB is a scientific/technical federal advisory committee, subject to the requirements of the Federal Advisory Committee Act (FACA), 5 USC App. 2. The SAB reports to the EPA Administrator.

b. Explain EPA's interpretation of ERDDA's requirement that the "Administrator, at the time any proposed criteria document, standard, limitation, or regulation under the ...[CWA]... is provided to any other Federal agency for formal review and comment, shall make available to the Board such proposed criteria document, standard, limitation, or regulation, together with relevant scientific and technical information in the possession of the Environmental Protection Agency on which the proposed action is based. Id.

Answer: Under section 4365(c), EPA is required to make proposed criteria documents, standards, limitations, and regulations available to the SAB when it submits such documents to other federal agencies for "formal review and comment." "Formal review and comment" occurs when a statute requires EPA to consult with another federal agency before it can take action.

c. Explain in detail the role and powers ERDDAA gives specific Congressional Committees. Do these powers included the ability to pose charge questions to the SAB? Why or why not? Do these powers include initiating the formation of new SAB panels to provide advice to Congress? Why or why not. Please cite any relevant statutory support for these positions and explanations.

Answer: The SAB is a federal advisory committee established by the EPA Administrator and, as with all EPA federal advisory committees, is subject to "administrative guidelines and management controls" established by the EPA Administrator. (See, FACA section 8(a)). As required by FACA, the EPA DFO calls each meeting and approves the agenda for each meeting.

EPA and staff of the House Science, Space and Technology committee are developing a process for managing questions on which the specific congressional committees would like SAB advice.

d. Does the SAB have the independent power to initiate reviews? Why or why not?

Answer: As stated in ERDDAA, the SAB provides scientific and technical advice as requested by the EPA Administrator. In addition under section 4365(c), the SAB has the authority to provide advice and recommendations on "proposed criteria document[s], standard[s], limitation[s], or regulation[s]" that are "provided to any other Federal agency for formal review and comment."

e. What specifically is requires to initiate review. How were these requirements determined?

Answer: SAB reviews are initiated when an EPA program office contacts the Director of the Science Advisory Board Staff Office.

QUESTIONS FOR THE RECORD
The Honorable Paul Broun (R-GA)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

IRIS Questions

Question 1: You testified on November 14 that "the Agency's ability to pursue its mission to protect human health and the environment depends upon the integrity of the science upon which it relies. I firmly believe that environmental policies, decisions, guidance, and regulations that impact the lives of all Americans must be grounded, at a most fundamental level, in sound, high quality, transparent, science." Additionally, at the September 17, 2012, opening public meeting of the National Research Council (NRC) IRIS Review panel, EPA NCEA Director Dr. Ken Olden stated in his presentation, that "openness and transparency will be the hallmark [of IRIS assessments] going forward." At the same NRC meeting, EPA Acting IRIS Director Vince Cogliano informed the panel that "new [EPA IRIS] initiatives will increase transparency and promote involvement of the scientific community." Finally, in the NRC Formaldehyde Report (2011), the committee noted in its recommendations to EPA for improving the IRIS process overall, "in the judgment of the present and past [NRC] committees, consideration needs to be given to how each step of the [IRIS] process could be improved and gains made in transparency and efficiency." (NRC Formaldehyde Report (2011), p. 164).

In order to understand the scientific underpinnings of many EPA documents, the public has been forced to resort to using FOIA, or other approaches, to try to obtain critical information and data that the EPA has relied upon. As these tools are time consuming and create legal hurdles, the information has not been available to the public in a timely manner to inform review and public comment.

- As part of a commitment to transparency and openness, do you agree that the data and information which underlies the key scientific studies the agency relies upon in important scientific reviews, assessments, and rulemakings (e.g., NAAQS Integrated Science Assessments, IRIS Toxicological Reviews), should be available to the public?

- Can you commit to making this information available in public dockets?

Answer: Transparency and scientific integrity are very important to the agency's work. Transparency is a critical element in the EPA's Scientific Integrity Policy: "To enhance transparency with the Agency, this policy...facilitates the free flow of scientific information. The Agency will continue to expand and promote access to scientific information by making it available online in open formats in a timely manner, including access to data and non-proprietary models underlying Agency policy decisions."

The July 2013 enhancements to the EPA's IRIS program are but one example of the Agency's commitment to this policy.

Question 2: Industry and federal research efforts have invested millions to better understand how chemicals interact with biological systems at human exposure levels in order to ensure development of human health risk assessment prediction models that are as accurate and science-based as possible. However, EPA has a long track record of dismissing these types of scientific biologically-based models and asserting that such approaches cannot prove the defaults are not warranted. Demanding that science proves a negative is an anti-scientific policy and indicates a deep seated prejudice against use of mode of action knowledge to replace defaults. Why shouldn't EPA use the most up to date knowledge on mode of action and dose response at environmentally relevant exposures in lieu of outdated default approaches for hazard identification and dose response throughout the Agency, including in the IRIS Program?

Answer: In developing an IRIS assessment, the EPA looks at all of the available data, including information about mode of action. We look at the entire database of scientific information, and we systematically review that information to develop the assessment. Consistent with the Agency's *Guidelines for Carcinogen Risk Assessment*, the EPA considers a critical analysis of all relevant information as the starting point from which a default option may be invoked if needed to address uncertainty or the absence of critical information. The EPA is committed to using sound science and continues to make significant progress in developing data-derived approaches and mechanistic models that require more detailed databases. While committed to these efforts whenever possible, in the absence of data, the Agency relies on scientifically-based and health protective default approaches.

Question 3: As EPA prepared to conduct a non-cancer toxicity assessment of Libby Amphibole Asbestos, it arranged by contract for development of additional data that EPA describe as "for development of the most accurate RfC for the Libby site." These new data included advanced radiographic imaging and pulmonary function studies of the population from which the RfC would be derived. The new data were collected by the University of Cincinnati as planned, but after several years remain unpublished and undisclosed by the federal government. EPA has neither revealed its assessment of the data nor explained why it chose to prepare its draft toxicity assessment without citation to or disclosure of underlying data that was sought by EPA to ensure the accuracy of the RfC.

- Please explain how EPA reconciles not disclosing the above data with its commitment to transparency and the NRC recommendation as noted above as well as the disclosure directives of FOIA and OMB Circular No. A-130 (Revised) which express the policy that the open and efficient exchange of scientific and technical government information supports the operation of democracy and excellence in scientific research.

Answer: The collection of the pulmonary function data was included as part of the original contract with the University of Cincinnati, but was not funded by the EPA. Accordingly, the Agency does not have the pulmonary function data. With respect to the other requested information, the EPA produced a number of documents in response to a FOIA request, including:

- A spreadsheet of X-ray data from the Marysville full cohort;
- Two files of smoking data corrections made by University of Cincinnati and the EPA;
- A spreadsheet of smoking data from 1980 and 2004;
- Three manuscripts discussing the data;
- A copy of the 2005 contract award to the University of Cincinnati;
- Minutes of meetings and a schedule of deliverables related to this contract;
- A copy of the contract with SRC, Inc.;
- Statements of Work for Task Orders 0003 – Guidance Addendum for Libby Amphibole, 0005 – Libby Human Health Risk Assessment, and 0007 – Libby Operable Unit 3; and
- Monthly reports related to Task Order 0005.

The EPA withheld from production other information consistent with the FOIA and OMB Circular A-130. While the Agency is committed to transparency, the EPA has an obligation to avoid disclosing material that may be confidential business information (CBI), under the Trade Secrets Act and also under Circular A-130, which directs that agencies "[l]imit the sharing of information that ... contains proprietary information to that which is legally authorized." Two of the three documents withheld in response to FOIA request EPA-08-2013-2405 were subject to claims or class determinations of CBI status. In particular, the High Resolution Computed Tomography (HRCT) data was produced by University of Cincinnati researchers and is subject to a confidentiality claim by the University; and the contract documents contain labor rates and similar information that the EPA redacted before release in accordance with CBI Class Determination 1-95. Before releasing the HRCT data or any of the redacted portions of the contract documents, the Agency is required to determine whether any CBI claims are valid and provide notice to the affected businesses.

In addition, the Agency is committed and required to protect citizens' privacy. As noted in Circular A-130, "[t]he individual's right to privacy must be protected in Federal Government information activities involving personal information." One of the withheld documents, the exposure matrix, raised these privacy concerns. It contains medical information that could

directly and indirectly reveal asbestos exposure associated with individual workers. Because the information contains medical or similar files of individuals, including information that could allow exposure data to be traced to specific persons, the disclosure of this document would constitute a clearly unwarranted invasion of personal privacy. Therefore, the EPA withheld this document under Exemption 6.

Finally, as discussed below, we have determined that the HRCT data and the exposure matrix are covered by the deliberative process privilege of FOIA Exemption 5, in addition to the other exemptions from disclosure discussed above.

- If EPA asserts that it does not possess or have access to any portion of the data, for instance because the funding mechanism changed and someone else paid for it, please explain:

    a. In the interests of transparency and sound science, why EPA did not affirmatively obtain for its own use the data during RfC development, especially since EPA had described the data as needed "for development of the most accurate RfC."

Answer: While the EPA included the collection of the pulmonary function and the advanced radiographic imaging data (HRCT data) in the contract with University of Cincinnati, the task for this data collection was not funded by the EPA. Further, the EPA did not affirmatively obtain any portion of this non-EPA-funded data, because the data had not yet been published in a peer-reviewed journal. The Agency uses only peer-reviewed, published data in IRIS toxicity assessments.

    b. Which governmental agencies provided funding for the development of the data

Answer: The Agency for Toxic Substances and Disease Registry provided the funds for these investigations by the University of Cincinnati.

- We understand that EPA received a Freedom of Information Act Request (FOIA) for the above data, and subsequently withheld a portion of the data based upon: the deliberative process privilege. EPA explained by letter of November 1, 2013 that it was withholding the data because:

    The withheld documents, and portions of documents, are protected by the deliberative process privilege because ***they reflect the internal discussions, advice, analysis, and recommendations that were considered in developing the [IRIS] Assessment for Libby Amphibole Asbestos.*** *The records were created prior to the finalization of this IRIS Assessment. Furthermore, withheld records were not circulated outside the Agency.* ***Release of the withheld material would prematurely disclose proposed policies before they are finally adopted*** *and cause public*

confusion by disclosing reasons and rationales that were not in fact ultimately the grounds for EPA's final assessment.

We further understand that the deliberative process privilege does not ordinarily cover scientific information and data, and "government researchers must be willing to expose the underlying data to public scrutiny." Chicago Tribune Co. v. United States Dept of Health and Human Servs., 1997 U.S. Dist. 2308 at *52 (N.D. Ill. Feb. 26, 1997). In light of this, please explain how the deliberative process privilege protects against disclosure of data, and whether the data should be produced to the public under FOIA.

Answer: In response to FOIA request EPA-08-2013-2405, the EPA withheld two documents based in part on deliberative process grounds: an Excel spreadsheet of advanced radiographic imaging data (HRCT data) and an exposure matrix with individual worker exposure calculations. In neither case was deliberative process the only basis for withholding. The Excel spreadsheet of HRCT data was claimed as confidential business information by the University of Cincinnati, while the exposure matrix contained medical information associated with individual workers. Accordingly, the EPA also withheld these documents under Exemptions 4 and 6 as applicable.

The EPA determined that the two withheld documents were also subject to the deliberative process privilege because the records were internal and not disclosed outside the federal government or its contractors; predecisional because the records were created before the finalization of the *IRIS Assessment for Libby Amphibole Asbestos*; and deliberative because the records were intertwined with decisions related to the IRIS assessment. Further, it would tend to reveal the "nascent thoughts" of Agency scientists and would thus "discourage the intellectual risk-taking so essential to technical progress." *Chemical Mfrs. Assoc. v. Consumer Product Safety Com.*, 600 F. Supp. 114, 118 (D.D.C. 1984). Accordingly, the release of this withheld information would prematurely disclose proposed policies before they were finally adopted and could cause public confusion by disclosing reasons and rationales that were not ultimately the grounds for the *IRIS Toxicological Review of Libby Amphibole Asbestos*, which has not yet been finalized.

The EPA does not find the unpublished *Chicago Tribune* opinion quoted above determinative. In that case, the district court made its statement about data not as a general rule of law but as a logical conclusion in light of the specific circumstances, which are different from the facts here. As you are aware, in the *Chicago Tribune* case, the District Court reviewed the appropriateness of asserting Exemption 5's deliberative process privilege on raw data in patient data forms. In contrast, the withheld records contain more than mere facts and raw data. The information included deliberative discussions and preliminary results

For these reasons, the Agency determined the information was exempt from disclosure under Exemption 5's deliberative process privilege.

Question 4: EPA is identifying the non-cancer adverse effect for the draft toxicological assessment of Libby Amphibole Asbestos as pleural plaques, asserting there is an association with certain functional impairment of the lung. It has come to our attention that the question of whether pleural plaques cause any clinically significant impairment is highly disputed and controversial. In light of this information:

- Is EPA considering discarding the assertion that pleural plaques cause lung decrements or any other functionally significant impairment because this initially proposed basis for selecting pleural plaques as the adverse effect lacks the needed scientific support?

a. If so, in the interest of transparency, please explain EPA's current position as to which adverse effect it is using for its non-cancer toxicological assessment, the basis for selecting that adverse effect, and whether the Agency will provide the opportunity for public comment on any change in its position.

Answer: The EPA's draft IRIS assessment of Libby Amphibole Asbestos includes an inhalation reference concentration (RfC) that is based on the presence of localized pleural thickening, an abnormality of the lining of the lung. "Localized pleural thickening" is a more recent term that encompasses what historically was known as "pleural plaques." This draft EPA assessment was reviewed by the Agency's Science Advisory Board (SAB) in 2013, and the question of basing the RfC on "localized pleural thickening" was discussed during this peer review. The SAB, in their peer review report, stated that "localized pleural thickening is an appropriate health endpoint for the derivation of the inhalation reference concentration." They went on to say that it is an "irreversible structural, pathological alteration of the pleura and is generally associated with reduced lung function." The final SAB peer review report is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/0/4F2A245C7160456B85257B030072E5D3/$File/EPA-SAB-13-001-unsigned.pdf

The EPA is currently revising the assessment to address the peer review and public comments. Following this, the revised draft will be reviewed by Agency scientists and the EPA will lead a science discussion with other federal agencies and the Executive Office of the President. After this, the EPA will move forward to complete the assessment.

Question 5: Do you agree that all studies should be independently judged based on their quality, strength, and relevance regardless of the author affiliation or funding source?

Answer: Author affiliation or funding source does not impact how studies are judged within the IRIS Program. In addition to quality, strength, and relevance, it is important that studies used in IRIS assessments are peer reviewed.

Question 6: Do you agree that chemicals associated with the human body's natural

processes should be addressed specifically and separately in the development of an EPA hazard value or risk assessment?

Answer: IRIS assessments are developed to provide information on the health effects associated with exposure to chemicals from sources over which the EPA has regulatory authority, including some chemicals that occur naturally at some level. There are many natural products of metabolism that can have toxic effects at high enough levels; the fact that a chemical is naturally produced does not make it "safe" at all doses. For noncarcinogens, IRIS typically estimates a concentration that if inhaled, or a dose that if ingested, is expected to be without appreciable risk of deleterious effects during a lifetime. The risk evaluated is typically the risk of increased effect – beyond the effects observed in the "unexposed" group or population. For carcinogens, the EPA typically estimates what additional risk might be caused by additional exposure compared with an "unexposed" population. As such, IRIS values generally already take into account amounts commonly produced by our own bodies ("endogenous exposures") in how they are derived.

Question 7: An analysis presented at the Society of Toxicology meeting showed that 67% of the Hazardous Air Pollutants (HAPs) have no IRIS value.

a. Do you believe that HAPs should be priorities for assessment within the IRIS Program?
b. What are the criteria for selecting chemicals for assessment within the IRIS Program?
c. Can you commit to developing a clearly articulated prioritization process for high priority IRIS assessments that benefits from, and is responsive to, engagement from all stakeholders?

Answer: The EPA recognizes that HAPs are important, and the IRIS Program works with the EPA's program and regional offices, including the Office of Air and Radiation, to develop the IRIS agenda. In the past few years, the IRIS Program has completed assessments for several HAPs, including tetrachloroethylene, trichloroethylene, methanol, and 1,4-dioxane. Additionally, the IRIS Program currently is working on developing assessments for several HAPs; examples include formaldehyde, naphthalene, and stryene.

The EPA periodically solicits nomination of chemicals to be assessed through the IRIS Program. Anyone can nominate chemicals for assessment, including the EPA Program Offices and Regions, other Federal agencies and the Executive Office of the President, as well as any stakeholders and the public. The EPA routinely publishes a Federal Register Notice announcing the opportunity to nominate chemicals for the IRIS agenda, and we also post information on the IRIS website. We use six general criteria for selecting chemicals for the IRIS agenda:

1. Potential public health impact;
2. EPA statutory, regulatory, or program-specific implementation needs;

3. Availability of new scientific information or methodology that might significantly change the current IRIS information;
4. Interest to other governmental agencies or the public;
5. Availability of other scientific assessment documents that could serve as a basis for developing an IRIS assessment; and
6. Other factors, such as widespread exposure.

The EPA has committed to the Government Accountability Office that it will better describe for internal and external stakeholders and the public the nomination and selection process for determining chemicals to be assessed by the IRIS Program, including the rationale for not selecting nominated chemicals.

Utility MACT and Other Air Quality Issues

Question 8: There are many groups that analyze the impacts of the EPA regulations. In particular, most of these groups analyze job losses. These include, for example, job losses due to higher energy prices. How does the EPA determine job losses that are caused by a proposed rule or a final rule? For example, do you use a model to determine job losses? When you analyze the job impacts of a rule that affects power plants-- for example, the Utility MACT rule that will cost $10 billion per year-does the EPA analyze job losses in industries that have to pay higher energy prices?

Answer: The EPA is keenly aware that these are tough economic times and there is particular concern about impacts on employment. That is why we have expanded our discussions of possible employment impacts in our rules. It is important to note that the EPA uses different approaches for employment analysis for different rules (drawing on peer-reviewed research), always takes public comment on those analyses, and has worked with academic researchers to improve our understanding of available tools.

Question 9: In a 2012 letter, you stated that "the best scientific evidence... is that there is no threshold level of fine particle pollution below which health risk reductions are not achieved by reduced exposure." Do you believe that any of the criteria air pollutants under the Clean Air Act (ozone, lead, sulfur dioxide, nitrogen oxides, carbon monoxide, coarse particulate matter) have a threshold below which they are not harmful to human health (or may be beneficial)?

Answer: The EPA's evaluation of scientific evidence in the most recent Integrated Science Assessments for each of the criteria air pollutants did not identify a level of exposure below which these pollutants pose no risk of harm. In the pollutant-specific ISAs, the EPA considered available scientific information from short and/or long-term exposure studies to examine the shape of the concentration – response functions and whether or not a threshold exists. While the EPA recognizes that there likely are biological thresholds for specific health responses for individuals, the PM ISA concluded that the overall evidence from existing epidemiological studies does not support the existence of thresholds for

populations.

Question 10: Last month, the World Health Organization classified outdoor air pollution as carcinogenic to humans. Do you think ambient air in America causes cancer?

Answer: The EPA has not conducted an evaluation of the potential of the collective mixture of outdoor air pollution to cause cancer in humans. However, in its 2009 Integrated Science Assessment for Particulate Matter, the EPA found that "overall, the evidence is suggestive of a causal relationship between relevant PM 2.5 exposures and cancer, with the strongest evidence from the epidemiologic studies of lung cancer mortality."

Question 11: According to the Office of Management and Budget, benefits from reducing particulate matter represent a majority of all benefits for all regulations across the entire federal government. Do you agree?

Answer: Based on recent reports from the Office of Management and Budget (OMB) on the benefits and costs of federal regulations, the EPA regulations have the highest monetized benefits across federal agencies, and a large percentage of these monetized benefits are from air pollution controls that reduce exposure to fine particles. The link between exposure to fine particle and adverse health effects is well-established in the scientific literature, including premature death, cardiovascular effects, and hospital admissions and emergency department visits for heart attacks, strokes, and asthma attacks. As OMB notes, it is not always possible to quantify or to monetize benefits in light of limits in existing information, and these non-monetized benefits can be important.

Question 12: Your predecessor, Lisa Jackson, previously testified that "If we could reduce particulate matter to healthy levels, it would have the same impact as finding a cure for cancer." Cancer kills roughly 600,000 people in this country each year. Do you agree with Administrator Jackson's statement?

Answer: Recent scientific publications are consistent with the findings of EPA's Second Prospective Study, The Benefits and Costs of the Clean Air Act, 1990 to 2020, that particulate matter is associated with thousands of premature deaths each year. Fann et al (2011) found that exposure to recent levels of $PM_{2.5}$ is associated with 120,000 to 320,000 premature deaths each year. A study in the New England Journal of Medicine (Pope et al. 2009) found that reduced levels of fine particles between 1990 and 2000 increased life expectancy at birth by about ½ a year; and, Correia et al. (2013) found that reduced particle levels between 2000 and 2007 further increased life expectancy.

In addition, the peer-reviewed burden of disease study concluded that ambient particulate matter pollution remains one of the top 10 health risk factors in the U.S. The study published in the Journal of the American Medical Association included co-authors from many health agencies. A copy of the study: http://jama.jamanetwork.com/article.aspx?articleid=1710486.

Question 13: Will your Agency propose a new National Ambient Air Quality Standard for ozone before the end of 2014?

Answer: The EPA has not yet reached a decision about what revisions to the ozone standards may be appropriate in light of the current scientific evidence. The EPA intends to issue a proposed decision addressing the question of whether it is appropriate to revise the current primary and secondary ozone NAAQS by December 1, 2014 (as required by court order), and the public will have a chance to review and comment on the proposal before the EPA issues a final rule.

EPA's Second Peer Review on the Bristol Bay Assessment

Question 14: In the development of the Agency's Bristol Bay Assessment, the Agency without soliciting any public input, asked the original twelve peer reviewers to give their opinions on how well the Agency responded to the comments that these peer reviewers made on the first draft of the Bristol Bay Assessment. Will you release the peer reviewers' comments now, before the final Bristol Bay Assessment is released? This will not in any way prejudice the Assessment, and will be in keeping with your commitment to both transparency and sound science.

Answer: On January 15, 2014, the EPA released the final Bristol Bay Watershed Assessment, which is available on EPA's website
at: http://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=253500.
Concurrent with release of the final assessment, the EPA posted the agency's response to the peer review comments
at: http://www.epa.gov/ncea/pdfs/bristolbay/EPAs%20Response%20to%20Peer%20Rev%20Comments.pdf. This response includes responses to the 2012 peer review comments as well as the 2013 peer review follow-up evaluations.

The EPA followed a transparent and open public process in developing the Bristol Bay Watershed Assessment, and the Assessment was subjected to rigorous and independent expert peer review. Twelve independent scientists with expertise in mine engineering, salmon fisheries biology, aquatic ecology, aquatic toxicology, hydrology, wildlife ecology, and Alaska Native cultures reviewed the assessment for its scientific quality. The same peer reviewers evaluated the revised draft to determine how well the EPA addressed their comments.

The peer review report from the 2012 peer review is available
at: http://www.epa.gov/ncea/pdfs/bristolbay/Final-Peer-Review-Report-Bristol-Bay.pdf

The peer review report from the follow-up peer review in 2013 is available
at: http://www.epa.gov/ncea/pdfs/bristolbay/PR_Follow-on_Comments.pdf

Climate Regulations

Question 15: When EPA released its regulations on new power plants in September, they were criticized because they would have a negligible impact on climate change. However, you have repeatedly emphasized that if we get enough countries on board we can make a difference, and you have said that a key goal of EPA's rules is to help leverage some kind of international agreement.

With that in mind, will you assure us that EPA will not take unilateral action on climate-which EPA itself acknowledges is not sufficient to make a measurable impact-but rather only proceed with rules if other major emitting countries like China agree to similar binding regulations? If not, why not?

Answer: The President's Climate Action Plan notes that it is imperative for the United States to couple action at home with leadership internationally. As part of this overall strategy, the EPA is contributing to a demonstration of U.S leadership through regulatory and non-regulatory programs that reduce emissions, take advantage of domestic sources of energy, and create jobs. Simultaneously, the Department of State is leading the effort to forge an effective global approach that includes greenhouse gas mitigation contributions from other major emitting countries, such as China.

Question 16: In 2009, President Obama committed to the U.S. to reducing greenhouse gas emissions 17 percent below 2005 levels by 2020. If EPA's power plant regulations are implemented, will the U.S. achieve that goal?

In accordance with the U N Climate Change Conference in Warsaw that concluded on November 23 with an agreement for additional cuts beyond 2020, the U.S. is expected to support additional reductions beyond the President's 2020 goal. What will EPA have to regulate in order to meet those commitments? In other words, does EPA intend to regulate natural gas-fired powered plants in order to meet these new commitments?

Answer: In January 2014, the US government completed its first Biennial Report, which included the latest estimates of historical emissions, and projected future greenhouse gas emissions out to 2020. The Biennial Report concluded that new measures, consistent with the President's Climate Action Plan, will put the United States on a path to reach the U.S. goal of achieving reductions in the range of 17 percent below 2005 levels by 2020. Included in the Climate Action Plan is EPA's Clean Power Plan. This proposed rule, if finalized, would contribute importantly to the achievement of our existing 2020 goal and to offering a robust post-2020 contribution in the context of the new climate agreement that will be concluded in Paris in 2015.

QUESTIONS FOR THE RECORD
The Honorable Larry Bucshon (R-IN)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

Definition of Fill Material

Question 1: The current definition of fill material, finalized in May, 2002, unified the Corps and EPA's prior conflicting definitions to solidify decades of regulatory practice. However, both EPA and the Corps have stated that they are now considering revising the definition of fill material. Ken Kopocis at his nomination hearing pointed to the 2009 Supreme Court decision in Coeur Alaska v. Southeast Alaska Conservation Council as justification, stating that there is "remaining ambiguity regarding circumstances where discharges of fill material (e.g., mine tailings) may also be covered by an Effluent Limitation Guideline." Do you believe that such ambiguity exists, and will EPA be seeking to address that issue?

Answer: The EPA agrees that some confusion remains after the 2002 Fill Rule and subsequent memo discussing implementation issues in the context of Alaska hardrock mining. The Corps and the EPA have at various times discussed actions for both the waste treatment system exclusion and the definition of "fill material" that could provide additional clarity. However, the EPA has no active discussions with the Corps at this time on revising the agencies' definition of "fill material."

Water Quality Criteria- Conductivity

Question 2: While EPA's conductivity "benchmark" that it had applied to Appalachian streams were set aside by the U.S. District Court for the District of Columbia in the case of NMA v. Jackson, EPA recently published several papers supporting its conductivity actions, and announced that it is developing a water quality criteria.

a. Will EPA's new criteria be a regional criteria, or applicable nationwide?

Answer: The EPA is currently working to develop a draft recommended field-based method for states to develop ambient aquatic life water quality criteria for conductivity. The method, if finalized, would provide a method that states and authorized tribes,located in any region of the country, may use to develop field-based conductivity criteria for adoption into water quality standards. It would not impose any binding water quality criteria on any state, but instead would provide recommendations to states as they develop such criteria. The field-based method will allow states to develop science-based conductivity criteria that appropriately reflect ecoregional- or state-specific factors such as background conductivity and ionic and aquatic community composition.

b. As is required by law, will EPA be applying its conductivity criteria to all CWA permits, regardless of industry?

Answer: As described above, the EPA is currently working to develop a draft recommended field-based method for states to develop ambient aquatic life water quality criteria for conductivity. If and when such a criterion is finalized, the EPA would work closely with states to ensure that its scientific recommendations, if adopted, are implemented consistent with the Clean Water Act.

c. In the past, EPA has not addressed scientific critiques that have produced evidence that conductivity is not a good indicator of benthic/aquatic health. Going forward, what plans does EPA have to take this growing number of studies into account?

Answer: Best-available peer-reviewed scientific literature, including literature developed by EPA scientists, identifies a strong causal connection between elevated conductivity levels and harmful effects on downstream aquatic life[1]. The EPA continues to rely on the latest peer-reviewed scientific information to develop its draft recommended national field-based method for conductivity. The EPA anticipates that its draft method will undergo independent external peer review and will be made available to the public to provide scientific views, which the EPA will take into account before finalizing the method.

Selenium Water Quality Criteria

Question 3: EPA is currently involved in a scientific assessment of Selenium that will be used to propose a new national Selenium water quality criterion. Yet, EPA constantly pushes back a potential release date for its proposal, which is causing uncertainty for operations nationwide.

a. What is EPA's proposed release for a selenium water quality criteria?

Answer: In May 2014, the EPA released a draft updated national recommended aquatic life criterion for selenium and requested scientific views on the draft document. The agency received scientific views until July 28, 2014 and is currently reviewing the scientific information it received. As of August 2014, the draft document is undergoing an independent, contractor-led, external expert peer review. After considering public and

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[1] Pond, G.J., M.E. Passmore, F.A. Borsuk, L. Reynolds, and C.J. Rose. 2008. *Downstream Effects of Mountaintop Coal Mining: Comparing Biological Conditions Using Family- and Genus-Level Macroinvertebrate Bioassessment Tools.* J. N. Am. Benthol. Soc. 27(3):717-737.
U.S. Environmental Protection Agency. *A Field-Based Aquatic Life Benchmark for Central Appalachian Streams (Final Report).* 2011. EPA-600-R-10-023F, Appendix C.
U.S. Environmental Protection Agency. *The Effects of Mountaintop Mines and Valley Fills on Aquatic Ecosystems of the Central Appalachian Coalfields* (Final Report). 2011. EPA-600-R-09-138A.

expert peer review feedback, the EPA will revise and publish the draft criterion document and subsequently again request public comment. Once finalized, the EPA's water quality criterion for selenium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. The EPA anticipates issuing final water quality criteria for selenium in 2015.

b. What is EPA's strategy for incorporating relevant scientific critiques and comments EPA receives into its final Selenium criteria?

Answer: As described above, the EPA has requested scientific views on its external peer review draft document, and also will be soliciting independent scientific peer-review comments on the document. The EPA will consider both public and peer review comments in revising the document prior to issuing a proposed criterion. The EPA will then again solicit and consider public comments on the proposed criterion, and revise the proposed criteria appropriately, prior to issuing final criteria. The EPA will also develop and publish summaries of how it addressed public and peer review comments it received on the draft criterion.

c. How is EPA taking the site-specific nature of Selenium issues into account when developing the national standard?

Answer: The EPA's draft selenium criterion takes into account a large national data set of measured selenium concentrations in aquatic systems, while also providing guidance on developing site-specific criteria. The draft criterion reflects a large database containing paired environmental measurements of selenium in water, fish, plankton, invertebrate species, and detritus from numerous sites as the basis for the national criterion, based on a peer reviewed, well-accepted model of selenium bioaccumulation developed by U.S. Geological Survey scientists (Presser and Luoma, 2010).[2] The model applied in the EPA's draft also enables development of site-specific selenium criteria through a scientific, rigorous analysis process provided in the text and appendices of the draft document. At the EPA's request, the USGS has provided technical comments on EPA's implementation of the model in this instance, including comments related to procedure, process, and inputs.

Court Cases- *National Mining Association v. Jackson*

Question 4: The U.S. District Court for the District of Columbia in the case of NMA v. Jackson recently struck down several EPA actions- specifically, EPA's Enhanced Coordination Process (ECP) and Multi-Criteria Integrated Resource Assessment (MCIR) for Appalachia surface coal mining, as well as EPA's guidance document, "Improving EPA Review of Appalachian Surface Coal Mining Operations Under the Clean Water Act, National Environmental Policy Act, and the Environmental Justice Executive Order" - as violating the CWA and Administrative

[2] Presser and Luoma, 2010. A Methodology for Ecosystem-Scale Modeling of Selenium. Integrated Environmental Assessment and Management. 6: 685-710.

Procedure Act, as well as, in the case of the guidance document, the Surface Mining Control and Reclamation Act. In your confirmation hearing, you stated that the Agency has directed its field offices not to use the guidance documents affected by the court decision. However, very few mining permits have been issued since the decision.

How does that outcome comport with the District Court's decision, and what additional steps do you think are needed to adhere to the District Court's decision?

Answer: On July 11, 2014, the U.S. Court of Appeals for the District of Columbia Circuit reversed the D.C. District Court's decision that set aside the EPA-Corps Enhanced Coordination Procedures and the EPA's July 21, 2011 final guidance on Appalachian surface coal mining operations.

The EPA is not the permitting authority in Appalachia for either Section 402 or Section 404 of the Clean Water Act. However, the EPA does provide comments on draft Section 402 permits developed by Appalachian States, and on Section 404 public notices issued by the U.S. Army Corps of Engineers. The EPA continues to review draft Clean Water Act permits and public notices and is eager to resolve any issues that arise in order to facilitate timely permitting, consistent with best-available science and the law.

Court Cases -*Mingo Logan Coal Co. v. EPA*

Question 5: In March, 2012, the U.S. District Court for the District of Columbia struck down EPA's retroactive revocation of a mining-related CWA Sec. 404 permit, holding unequivocally that EPA has no authority to retroactively veto CWA Sec. 404 permits issued by the U.S. Army Corps of Engineers. However, EPA appealed that decision and in April of 2013, the U.S. Court of Appeals for the District of Columbia reversed the decision of the District Court.

a. What do you think the practical effect on industry would be of having Sec. 404 permits be subject to EPA's veto even years after permit issuance and even if the permittee is in full compliance with the terms of the permit?

Answer: The EPA takes very seriously the authority provided to the Agency by Congress, pursuant to Section 404(c) of the Clean Water Act (CWA), to determine whether discharges of dredged or fill material into a specified site in waters of the U.S. would result in an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas. Indicative of the EPA's thoughtfulness in using this authority is the fact that the Agency has completed 13 Final Determinations since 1972 pursuant to CWA Section 404(c) -- only three of which were in connection with projects for which Section 404 permits had issued already. To put this in perspective, over the same period of time, the Corps of Engineers is estimated to have authorized more than two million activities in waters of the U.S. under the CWA Section 404 regulatory program. As these numbers demonstrate, the EPA has worked successfully with the Corps and permit applicants to

resolve concerns without exercising its Section 404(c) authority in all but a miniscule fraction of cases.

As you are aware, this matter remains in litigation, so the EPA is unable to discuss this matter in greater detail.

b. During deliberations on the Clean Water Act in Congress, Senator Muskie noted that there are three essential elements to the Clean Water Act-- "uniformity, finality, and enforceability". How do the assertions made by EPA regarding the scope of its authority under Sec. 404 comport with the notion of permit finality? How have you, pursuant to your testimony at your confirmation hearing, worked to implement the CWA to provide uniformity, finality and enforceability?

Answer: Please see response to question 5(a) above.

Bristol Bay Draft Watershed Assessment

Question 6: In response to petitions from environmental organizations to initiate a 404(c) veto process for a potential mine site in Bristol Bay before a permit application was submitted, EPA - pointing to its authority under CWA Sec. 104 - initiated a draft watershed assessment that involved the crafting of a hypothetical mining scenario in Bristol Bay.

a. EPA has stated that the assessment will not have any legal consequences, but also that it is intended to provide a scientific and technical foundation for decision-making. How exactly does EPA intend to utilize this study under your leadership?

Answer: The EPA conducted the Bristol Bay Watershed Assessment to better understand the Bristol Bay watershed and its resources. As a scientific report, the final assessment did not recommend policy or regulatory decisions. The EPA believes the final assessment can serve as a valuable resource for the public and for federal, state, and tribal governments as they consider how best to address the challenges of mining and ecological protection in the watershed.

Separate from the Bristol Bay Assessment but based in part on the results of that assessment, on February 28, the EPA announced that the agency was initiating a process under the Clean Water Act to identify appropriate options to protect the world's largest sockeye salmon fishery in Bristol Bay, Alaska, from the potentially destructive impacts of the proposed Pebble Mine. The EPA based its action on available information, including data collected as part of the agency's Bristol Bay Watershed Assessment as well as mine plans submitted to the U.S. Securities and Exchange Commission. On July 18, EPA Region 10 issued a Proposed Determination pursuant to Section 404(c) of the Clean Water Act and is currently seeking public comments on its proposal. The EPA held seven public hearings from August 12-15 at which the public could provide oral or written comments to the agency. EPA Region 10 will also meet with tribes for formal consultation. Following the close of the public

comment period, EPA Region 10 will review public comments on its proposal and consider next steps in the process, which could include moving toward a Recommended Determination to the EPA Assistant Administrator for Water.

b. EPA has full authority under the well-established Sec. 404 process to review any future permit application submitted to make a determination as to whether or not there will be any of the unacceptable adverse effects listed in CW A Sec. 404(c) at the disposal sites being considered by the U.S. Army Corps of Engineers, including unacceptable impacts to fishery areas and wildlife. Why, then, is EPA using its limited resources to conduct a watershed assessment on a hypothetical mining scenario that even EPA's scientific review panel found did not accurately reflect the conditions of a real mine, rather than allow the companies that have invested millions of dollars to submit their proposal which EPA would then review?

Answer: As described above, the EPA developed the Bristol Bay Watershed Assessment in response to petitions from nine federally recognized tribes and other stakeholders who asked us to take action to protect Bristol Bay's salmon populations. They expressed concern that the Bristol Bay salmon fishery would be at risk from the potential Pebble Mine. We also heard from other tribes and stakeholders who support development in the Bristol Bay watershed and have requested that the EPA take no action and allow a typical permitting process to proceed. In light of the agency's important Tribal Trust and consultation responsibilities and the significant fishery resources of Bristol Bay, the agency decided to conduct a scientific assessment to understand how large-scale mining could potentially affect water quality and salmon ecosystems in the watershed. As described above, the EPA believes that its final assessment is valuable to the public and for federal, state, and tribal governments as they consider how best to address the challenges of mining and ecological protection in the watershed.

c. What impact do you think EPA's actions with respect to Bristol Bay will have on investment in U.S. property and natural resource development?

Answer: As noted above, EPA Region 10 recently issued a Proposed Determination pursuant to Section 404(c) of the Clean Water Act and is currently seeking public comments on its proposal. Through this process, the agency will work to identify appropriate options to protect the world's largest sockeye salmon fishery in Bristol Bay, Alaska, from the potentially destructive impacts of the proposed Pebble Mine. The agency made clear that its action reflects the unique nature of the Bristol Bay watershed as one of the world's last prolific wild salmon resources and the threat posed by the Pebble deposit, a mine unprecedented in scope and scale. The agency also made clear that its action does not reflect any EPA policy change with respect to mine permitting.

d. Has EPA considered the positive environmental justice impacts high-paying jobs and tax revenue will have on the region?

Answer: As part of the EPA's development of the Bristol Bay Watershed Assessment, the agency reviewed existing information on salmon fishery economics, which provided important contextual information about the importance of the salmon fishery. This information is provided in Volume 2, Appendix E of the final Bristol Bay Watershed Assessment.[3] However, the agency's watershed assessment did not represent a cost-benefit analysis of mining or fishing, nor did it present an evaluation of the economic viability or economic impacts of any proposed large-scale mining project.

QUESTIONS FOR THE RECORD
The Honorable Steve Stockman (R-TX)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

Interagency Taskforce on Development of Unconventional Natural Gas Resource

Background Statement on Task Force:

- On April 13, 2013, the President signed an executive order (EO) forming an interagency Task Force to support the safe and responsible development of unconventional natural gas resources.
- In the Policy section of that EO the president states that "it is vital that we take full advantage of our natural gas resources" while doing it safety.
- The EO outlines the function of the Task Force as coordinate agency policy activities, sharing scientific and economic information, long-term research and infrastructure planning and consultation among agencies.
- EPA is a member of that task force at the Deputy level according to the EO.

Question 1: Mrs. McCarthy, who is EPA's representative to this Task Force and how often does it meet?

Answer: The EPA's interim representative to the Task Force is Acting Deputy Administrator Lisa Feldt. An outgrowth of the Task Force meetings was greater support for interagency efforts to coordinate high priority research associated with safely and prudently developing unconventional oil and gas (UOG) resources through the Federal Multiagency Collaboration on Unconventional Oil and Gas Research. The EPA, the Department of the Interior and the Department of Energy have each contributed policy and technical officials to the Collaboration's Steering Committee. Through this team and the creation of a Technical Subcommittee, comprised of DOI, DOE, EPA, and Department of Human Health Services scientists and engineers, the agencies help foster research collaboration and coordination. The collaboration's Steering Committee has been meeting on a weekly basis.

[3] The final assessment and its appendices are available at http://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=253500.

Question 2. Have you personally been briefed on the Task Force activities?

Answer: I am regularly briefed on the EPA's research activities, including our collaboration and coordination with fellow federal agencies.

Question 3: Can you provide an update to this Committee today on EPA's activities and focus areas as a member of this Task Force?

Answer: The DOE, DOI and EPA continue to coordinate and collaborate on research devoted to UOG production to conduct timely scientific and technology research. A significant part of this effort involves the overall sharing of information among the agencies. The three agencies have also engaged other Federal partners and stakeholders through a variety of mechanisms. Together the agencies have finalized a strategy document that identifies current and future research needs, and highlights projects that are both underway and could be undertaken to address these needs, available at (http://unconventional.energy.gov).

Question 4: There are a number of Executive Branch departments and agencies engaged in some fashion in unconventional resource development. Can you provide your opinion on the level of coordination on policy activities, sharing of information and, in particular, and your thoughts on long-term research in the area of infrastructure planning?

Answer: As mentioned above, EPA, DOE, and DOI are coordinating their research efforts devoted to high priority research associated with safely and prudently developing UOG resources. A major part of this effort involves the sharing of information among the agencies.

Question 5: Last week, Interior Secretary Jewell said that there is a lot of misinformation about fracking and that quote "Fracking has been done safely for many, many years."

a. Do you agree with Secretary Jewell that fracking has been done safely for many years?

Answer: Responsible development of America's unconventional oil and natural gas resources offers important economic, energy security, and environmental benefits. The EPA is committed to working with states and other stakeholders to understand and address potential concerns with unconventional oil and gas development so the public has confidence that it will proceed in a safe and responsible manner. In so doing, we will continue to follow a transparent, science driven approach with significant stakeholder involvement. The EPA continues to move forward on our national research study on the potential impacts of hydraulic fracturing for oil and gas on drinking-water resources in response to a request from Congress. The agency is working in consultation with a variety of stakeholders and has provided many opportunities for the exchange of information and input on the study design and the research as it progresses.

b. What parts of the fracking process do you feel are being done safely?

Answer: Responsible development of America's unconventional oil and natural gas resources offers important economic, energy security, and environmental benefits. As stated earlier, the EPA is committed to studying and addressing potential concerns related to unconventional oil and gas development so that the public has confidence that it will proceed in a safe and responsible manner. In so doing, we will continue to follow a transparent, science-driven approach with significant stakeholder involvement.

c. Are there any parts of the fracking process that you feel are not safe?

Answer: See (b) above.

Credibility and Ability of EPA Science

Background Statement on EPA Science

- In 2009 legislation, Congress directed EPA to conduct a study on hydraulic fracturing and groundwater.
- Rather than following the statute –how HF affects groundwater-EPA has outlined a sprawling study plan that goes well beyond groundwater issues.
- EPA initially did not recognize this as a "highly influential" study subject to OMB's Peer Review Bulletin, has not been able to garner an industry partner in conducting perhaps the most important aspect of its study plan – the "before and after" prospective study, and also had an EPA science debacle when its scientists independently pursues research in Pavillion, WY.
- Today, at the end of 2013, EPA still has not issues the study and we are told not to expect it until 2016.

Question 1: Can you please describe for us what happened with the study of effects of hydraulic fracturing on Water? Why it got so far off course, and what EPA is doing to get this effort back on track? What do you think this says about the state of EPA's science process and its ability to be timely and relevant?

Answer: EPA is conducting an assessment of the potential impacts of oil and gas hydraulic fracturing activities on drinking water resources in the United States. The study scope was designed to meet Congress' request and was established in November 2011 in the Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, after public comment and peer review by the Science Advisory Board. The scope has not changed since the release of the final study plan. The assessment will represent the state of the science on this topic as supported by an extensive review of the literature, results from recently completed EPA research projects, and input from states, industry, non-government organizations, the public, and other stakeholders. We remain committed to providing a high quality scientific document.

a. Can you please explain the decision to conduct a sprawling study rather than investigate the narrow question Congress posed?

Answer: The scope of the *EPA's Study of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources*, which was supported by the Science Advisory Board, was designed to be responsive to the request from Congress. There has been no expansion of the scope beyond the original appropriations language.

b. Can you please explain the initial decision not to designate this as a "highly influential" document subject to OMB's Peer Review process?

Answer: The EPA designated the report a Highly Influential Scientific Assessment. There was no initial decision to not designate the report as such.

c. I am concerned that EPA has not been able to get any industry partners for the before-and-after prospective case study. Can you please explain the apparent impasse between EPA and industry stakeholders on the issue? Can you please describe the issues around protocols around the study that we hear is one source of friction between EPA and industry?

Answer: We have worked closely with industry partners to try to identify suitable locations for prospective case studies that meet the scientific needs of the study and industry's business needs. We continue to explore opportunities and, so far we have not identified a suitable location. For a location to be suitable, it is necessary to gather a minimum of one year of characterization data for ground water and surface water prior to and following unconventional exploration activities in the study area, and for there to be no other hydraulic fracturing activities on adjacent properties, during the entire study period, which could last several years.

d. I would note that the University of Texas, EDF and 9 companies partnered for a landmark study to look at emissions from oil and gas operations. That study took about a year. This tells me that industry partnerships are possible and that your agency should be able to find common ground with industry to conduct the study.

EPA's Role in Assuring the Public that Fracking is Safe

Background Statement on EPA's Role in Public Confidence:

- In that same interview last week, Secretary Jewell called on industry to educate the public on safety of hydrofracking
- I agree, and it would seem to me that industry is trying to do just that:
  - Industry is participating with NGO's and academics to confirm the low emission rates of methane
  - Industry is implementing more stringent standards for drill sites, well bores and air emissions

- Industry is working with states to implement more stringent regulatory requirements to further assure the safety of their operations
- Industry has stepped up to the plate to try and educate the public on the safety of their operations

- However, EPA has not been so helpful:
  - You publish ground water contamination studies that are then discredited and withdrawn
  - You don't rebut flawed air emission studies that report methane emissions an order of magnitude higher than EPA's estimates
  - Last week in testimony before the Senate EPW, your Director of Atmospheric Programs (Ms. Sarah Durham) couldn't even make a positive statement about the UT/EDF air emissions study that basically confirmed EPA's estimate of emission from unconventional gas development operations

Question 1: Mrs. McCarthy, what role do you see EPA playing in assuring the public that unconventional oil and gas development, development that President Obama supports, is safe?

Answer: Responsible development of America's unconventional oil and natural gas resources offers important economic, energy security and environmental benefits. The EPA is working with stakeholders to help ensure that oil and gas development is done in a safe and responsible manner. In particular, the EPA is working in partnership with states, which have key regulatory authority relevant to unconventional oil and natural gas extraction. The goal of EPA's drinking water assessment report is to help eliminate any potential impacts to drinking water from unconventional oil and gas development.

Question 2: Do you agree that EPA mis-steps around groundwater contamination can lead to a loss of public confidence?

Answer: In its groundwater investigations, the EPA took action when the agency became aware of information indicating potential threats to human health. The EPA's actions generally focused on obtaining additional data and information in an effort to better understand and assess potential threats to public health and the environment. The agency consulted with its state and tribal partners prior to taking such measures and shared data and information with homeowners, the relevant state agencies and, where applicable, tribal authorities. In each case, the EPA relied upon sound science as it sought to provide clarity to these stakeholders and ensure that public health was protected, while working closely with individual states. The EPA will continue to work with state partners and other stakeholders to help ensure that oil and gas extraction is done in a safe and responsible manner.

Question 3: Do you agree that failure to acknowledge reports confirming your own emission estimates and failure to discredit obviously flawed reports can lead to a loss of public confidence?

Answer: The EPA continues to use the best available data to produce its estimates of GHG emissions in the U.S. Greenhouse Gas Emissions and Sinks Inventory (Inventory). In recent years, the natural gas sector has experienced significant growth and changes in industry practices, and only recently have newer data and studies become available to improve our understanding of emissions for these sources. In the Inventory, the EPA discusses relevant information and data available on emissions from the oil and gas sector from reports that confirm, as well as conflict with the EPA estimates.

Recently, the EPA received new information and data related to the oil and gas sector emission estimates through the annual Inventory preparation process, the formal public notice and comment process of the proposed oil and gas New Source Performance Standards for volatile organic compounds, and through a stakeholder workshop on the natural gas sector emissions estimates. All relevant information provided was carefully evaluated, and updates were made to two key sources: liquids unloading, and completions with hydraulic fracturing and workover with hydraulic fracturing (re-fracturing). The EPA updated its estimates for liquids unloading using new industry data sets, and used data reported to the Greenhouse Gas Reporting Program (GHGRP) to develop a revised method for hydraulically fractured well completions and workovers. As expected, incorporating newly available data has resulted in changes to emissions estimates for the oil and gas sector overall. Updating estimates with newly available data is part of the EPA's standard process for improving the Inventory, and we look forward to receiving feedback on the EPA's approach and use of the data through the Inventory review process.

Question 4: Can you see how EPA's silence on the wide range of hydrofracking issues being debated can lead to a loss of public confidence?

Answer: The EPA is helping build public confidence through several initiatives, first and foremost being the Agency's national research study on the potential impacts of hydraulic fracturing for oil and gas on drinking-water resources. The agency is working in consultation with a variety of stakeholders and has provided many opportunities for the exchange of information and input on the study design and the research as it progresses. Ultimately, the results of this study are expected to inform the public and provide policymakers at all levels with high-quality scientific knowledge.

The EPA is also working to provide regulatory clarity with respect to existing laws and use existing authorities where appropriate to enhance public health and environmental safeguards. For example, in February, the EPA released an interpretive memorandum to clarify requirements under the Safe Drinking Water Act's Underground Injection Control program, for underground injection of diesel fuels in hydraulic fracturing for oil and gas extraction. The agency also released technical guidance containing recommendations for EPA permit writers to consider in implementing these UIC Class II requirements.

In addition, on May 9, 2014, the EPA issued an Advance Notice of Proposed Rulemaking

under Toxic Substances Control Act sections 8(a) and 8(d) seeking public comment on what information should be reported and disclosed for hydraulic fracturing chemicals and mixtures and the approaches for obtaining this information, including non-regulatory approaches. EPA is also soliciting input on incentives and recognition programs that could support the development and use of safer chemicals in hydraulic fracturing. This public process will help inform EPA's efforts to promote the transparency and safety of unconventional oil and gas activities. The public can provide comments through September 18, 2014. The EPA also anticipates moving forward on revisions to existing technology-based wastewater regulations to provide additional controls on discharges to wastewater treatment plans associated with the unconventional oil and gas extraction industry.

In addition, in 2012 the EPA finalized the first federal air regulations for natural-gas wells that are hydraulically fractured, along with requirements for several other air emission sources in the oil-and-gas industry that were not regulated at the federal level. A key component of the final rules is expected to yield a nearly 95 percent reduction in volatile organic compounds emitted from more than 11,000 new hydraulically fractured gas wells each year. To help reduce burdens on operators and regulators while achieving environmental benefits, the 2012 rule provides for an alternative to submission of voluminous hard copy well completion records as part of annual compliance reports. Specifically, this "NextGen Compliance" alternatives allows operators to document compliance with the green completion requirements by submitting well identification information and digital photographs (bearing the time, date, and geographic coordinates) of green completion equipment in operation at the well during flowback following hydraulic fracturing.

Question 5: Secretary Jewell, less than 6 months into the job, is trying to instill some confidence with the public on hydrofracking – isn't it time EPA do so as well?

Answer: As detailed in #4, above, the EPA is moving forward on a wide variety of initiatives related to hydraulic fracturing. The agency is seeking to identify innovative approaches that could result in greater environmental benefits and transparency while remaining mindful of the importance of this sector to our country. We are continuing to look at further opportunities for the EPA to support implementation by states and industry of hydraulic fracturing best practices.

Clean Air Science Advisory Committee Transparency and Accountability Issues

Background

- On September 11, the EPA Inspector General released a final report titled *"EPA Can Better Document Resolution of Ethics and Partiality Concerns in Managing Clean Air Federal Advisory Committees"*.

- The report raised a number of alarming issues regarding the operation of EPA's Clean

Air Science Advisory Committee (CASAC) and leaves many unanswered questions.

- CASAC is the advisory committee that during the past five years has recommended dramatic reductions in standards for nitrous oxides, sulfur oxides, particulate matter and ozone.

- The current ozone standard is under review again by CASAC and they are expected to make yet another recommendation to dramatically lower the ozone standard.

CASAC Financial Conflicts of Interest and Independence

Background on Financial Conflicts of Interest and Independence:

- CASAC members and contract advisors, or research institutions they are affiliated with, receive substantial grants from EPA for air quality research.
- In one case, Dr. Jonathan Samet, or his affiliated research institutions received almost $30 million dollars in EPA grants for research; Dr. Samet was the chair of the PM CASAC and currently serves on the ozone CASAC.
- In fact, several serving CASAC members have received over $1 million dollars from EPA for research.
- The IG Report confirms that a CASAC member's research grant is a potential area of concern if the Committee plans to address work performed under the research grant.
- Despite the millions in grant funding to CASAC members, it is unclear from the Report whether anyone actually investigated to see if those grants compromised their independence.
- The IG also found 9 instances where steps taken to mitigate independence or partiality matters were either not adequately documented or needed additional steps to sufficiently address potential independence or partiality concerns.
    - This included two instances where CASAC members contributed to studies or sections of CASAC reports under review by the CASAC panel creating a situation where they were opining on their own work.

Question 1: Mrs. McCarthy, it's hard to know where to start. EPA is selecting advisors that are receiving millions of dollars from EPA for research. According to the IG Report, some of the selected advisors were also found to be reviewing or opining on elements of their own work; and that the Agency is not following existing agency procedures regarding conflicts of interest, or taking steps to mitigate issues when they are identified. What steps is EPA taking in light of the IG Report to assure that the current CASAC ozone panel is impartial?

Answer: The Inspector General (IG) concluded that the EPA Science Advisory Board Staff Office "has adequate procedures for identifying independence and impartiality concerns," (EPA Office of Inspector General, Report No. 13-P-0387, Sept. 11, 2013) but called for better documentation when members with independence concerns or the appearance of a lack of

impartiality as defined in 5 C.F.R. 2635 are allowed to serve.

For the current ozone panel, the EPA has evaluated and will continue to evaluate experts on the basis of their confidential financial disclosures, responses to the four supplemental ethics questions on the Confidential Financial Disclosure Form (EPA Form 3110-48) and other information gathered by the EPA staff. The EPA Form 3110-48 requests detailed information about candidates' employment, consulting and volunteer work, compensated expert testimony; sources of research or projecting funding, assets and information to determine any loss of impartiality. The form requests experts to respond to four supplemental ethics questions with respect to the review document under consideration:

1. Do you know of any reason that you might be unable to provide impartial advice on the matter to come before the panel/committee/subcommittee or any reason that your impartiality in the matter might be questioned?
2. Have you had any previous involvement with the review document(s) under consideration including authorship, collaboration with the authors, or previous peer review functions? If so, please identify and describe that involvement.
3. Have you served on previous advisory panels, committees or subcommittees that have addressed the topic under consideration? If so, please identify those activities.
4. Have you made any public statements (written or oral) on the issue that would indicate to an observer that you have taken a position on the issue under consideration? If so, please identify those statements.

In its ethics review, the EPA strives to ensure that panel members are fair-minded scientific and technical experts, free from conflicts of interest and the appearance of a loss of impartiality as defined in 5 C.F.R. 2635, and possessing the ability to engage in constructive discussions among scientists with disparate perspectives. The EPA follows required legal procedures and documents any special circumstances when members with conflicts of interest or the appearance of a loss of impartiality as defined in 5 C.F.R. 2635 are allowed to serve on a panel. The EPA also documents its resolution of any question that may be posed related to independence or lack of objectivity of an expert allowed to serve on a panel.

Question 2: Please explain to me why the CASAC recommendation last year to lower the PM standard, a recommendation the EPA took, was not biased or not independent given these serious findings by the IG?

Answer: We could find nothing in the IG report (EPA Office of Inspector General, Report No. 13-P-0387, September 11, 2013) that would call into question the impartiality of the recommendations of the CASAC Particulate Matter Review Panel.

Question 3: Will you commit here today not to select CASAC members and consultants that receive EPA funding for NAAQS related air quality research? There are certainly plenty of qualified individuals out there not on EPA's payroll.

Answer: Consistent with OMB guidance and other federal agency practice, the EPA does not consider the current or past receipt of EPA grants generally to be an appearance of a loss of impartiality, but instead considers information about the EPA grants as they relate to the specific advisory activity. The EPA will continue to follow guidance issued from the Office of Management and Budget that states that "When an agency awards grants through a competitive process that includes peer review, the agency's potential to influence the scientist's research is limited. As such, when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review." (Joshua Bolten, Director, Office of Management and Budget, Issuance of OMB's Final Information Quality Bulletin for Peer Review, 12-16-04.)

CASAC Lack of Impartiality

Background:

- Federal ethics regulations require CASAC members to avoid appearances of a lock of impartiality.
- EPA's Peer Review Handbook states that experts that have made public pronouncements on an issue may lack impartiality and should be avoided; and that individuals who have "taken sides" should be avoided.
- In 2008, EPA selected Jonathan Samet as Chair of CASAC even though he had published an article in 2006 opposing EPA's current PM standard.
- As Chair of CASAC, Dr. Samet presided over the review of the PM standard and made recommendations to lower the PM standard.
- Dr. Samet failed to disclose the public statement in the disclosure form that specifically asked if he "made any public statements, written or oral, on the issue that would indicate to an observer that you have taken a position on the issue under consideration. "
- CASAC members are also required to update this form annually and to participate in an ethics training course.

Question 1: Has anyone at EPA asked Dr. Samet why he omitted this important information despite a direction question on his form?

Answer: Dr. Samet provided information about his public statements. In 2006, the Confidential Financial Disclosure Form (EPA Form 3110-48) did not request information on public statements. However, Dr. Samet did disclose his 2006 editorial in the *American Journal of Respiratory and Critical Care Medicine* in an e-mail to Designated Federal Officer Fred Butterfield dated 1-31-06 in direct response to a question about past public statements.

Question 2: Did Dr. Samet submit a new financial disclosure statement annually while Chair? If so, did he continually omit disclosure of his public statements on all his forms?

Answer: Yes, Dr. Samet submitted annual disclosures. He did not omit disclosure of his public statements.

Question 3: Did Dr. Samet participate in all the required ethics training courses?

Answer: Yes

Question 4: Why did the SAB staff not check his publication list to see if a public statement had been made?

Answer: Dr. Samet did disclose his 2006 editorial in the *Am J Respir Crit Care Medicine (Vol 173, pp. 365-369)* in an e-mail dated 1-31-06 to Designated Federal Officer Fred Butterfield.

Question 5: Why aren't the financial disclosure forms (in whole or part) made public to allow the public to assist in reporting financial or potential impartiality conflicts?

Answer: Financial disclosures are deemed confidential under 5 CFR 2634.901(d).

Question 6: If EPA had known, would the SAB staff have avoided Dr. Samet's appointment as Chair of CASAC?

Answer: No. In fact, the EPA was informed of Dr. Samet's 2006 editorial cited above. The EPA considers the full picture of an individual's professional activities, including public statements, as well as the individual's reputation in the field. Given a scientist with a long track record of highly-regarded research and publications, it is reasonable to expect that he would reach conclusions based on his professional activities. Based on the totality of Dr. Samet's scientific credentials and published work, we did not and do not believe his statement is evidence that he is not objective and open-minded. Moreover, the National Academies[4] and other groups have stated that experts who have made public statements should not be excluded experts as long as they can be fair-minded in participating in advisory activities.

Question 7: Should EPA have a clearer policy of not appointing a person to a scientific advisory committee like CASAC if conclusive information has been provided showing a public statement has been made that suggests a clear bias (or removing them, if the evidence emerges after they have been appointed)?

Answer: The EPA's policy is stated above in response to questions 1 and 6.

Question 8: Given that the Chair of CASAC was clearly biased in his opinion prior to serving as Chair of the PM CASAC panel, did his participation undermine the ability of CASAC to provide independent advice during the 2012 PM review? Does that compromise the scientific validity of the resulting NAAQS?

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[4] The National Academies, "Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports," May 2003: Available at http://www.nationalacademies.org/coi/bi-coi_form-0.pdf (Accessed 10/21/13).

Answer: No. The CASAC PM Panel developed scientifically credible and objective advice on the matters brought before it by the EPA.

The Honorable Dan Lipinski (D-IL)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

Question 1: According to the EPA Inspector General, EPA violated Section 1605 of the American Recovery and Reinvestment Act, which plainly requires all public works projects funded by ARRA to use iron, steel, and manufactured goods that are produced in the United States. The IG found that submersible pumps and centrifugal blowers for wastewater treatment plants in Illinois were purchased from foreign companies that control no manufacturing facilities in the U.S. In addition, EPA has claimed that payments to American lawyers and marketing firms made these goods Buy American compliant. This incorrect interpretation of the law was perhaps the most disconcerting part of this incident because it could lead to future similar violations of Buy American laws. Can you tell me what steps the EPA has taken since this incident, and will take in the future, to prevent similar incidents? How will EPA ensure it doesn't spend taxpayer dollars on foreign goods when that money could be spent on American made items?

Answer: The EPA Office of the Inspector General (OIG) issued OIG Report 11-R-0700, "American Recovery and Reinvestment Act Site Visit of Wastewater Treatment Plant-Phase II Improvement Project, City of Ottawa, Ill.," on September 23, 2011. Two specific issues were raised by the report: first, that the wastewater treatment plant in Ottawa, IL, did not comply with the Buy American requirement of the American Recovery and Reinvestment Act (ARRA); and second, that the guidance provided by the Office of Water (OW) for compliance with the Buy American requirement was faulty and should be revised in accordance with OIG recommendations.

After initial discussions between OW and the OIG led to continuing disagreement about the legal requirements of the Buy American requirement, as well as the test described in the OW guidance, the matter was referred to the EPA's Chief Financial Officer for arbitration and resolution. No resolution was reached. The OIG, following resolution procedures, requested final resolution by the Acting Administrator of EPA. Both parties met with the Acting Administrator on April 1, 2013.

The OW guidance required a three-question test to determine whether substantial transformation of a manufactured good took place in the U.S. In order to prove that substantial transformation took place, only one of the three questions needed to be answered affirmatively. The first question addressed situations in which all components of a good were manufactured in the U.S. and assembled into the final product in the U.S. The second question addressed situations in which important processing work was done in the

U.S. prior to assembly. The third question, which addressed situations in which the most significant of the potentially transformative work in the U.S. is assembly of components into the manufactured good, was the only one at issue in this dispute. Under no circumstances would the hiring of American lawyers or marketing firms be a factor in determining whether a manufactured good was substantially transformed in the U.S. The OIG agreed that the use of a substantial transformation test was appropriate, but felt that the third question was not stringent enough.

On May 10, 2013, the Acting Administrator issued his final decision on the matter and concluded that the test as set out by OW was appropriate for use in determining whether manufactured goods were substantially transformed in the US and did not require revision. The decision memo resolved the OIG recommendation concerning the guidance and the alleged noncompliance on the Ottawa project.

In circumstances where a finding of noncompliance with the Buy American requirement was not disputed, the violating community was either required to remove the item in question and replace it with an American-made good, or if removal was impossible or impractical, the community was required to reimburse the State SRF program the cost of the non-U.S. item.

Question 2: A constituent company in my district, Seeler Industries, has had questions about enforcement of regulations made under the General Duty provision of the Clean Air Act. As you know, under the General Duty provision, companies have a general duty to maintain a safe facility preventing and minimizing the effects of releases of extremely hazardous substances. I completely support the principle behind this provision, but in practice this company has found that regional EPA inspectors have a wide authority to enforce the provisions they see fit. In addition, according to the company, the rules under the general duty provision may run counter rules promulgated by DHS for chemical safety. What are you doing to make clear to chemical companies what the requirements are for compliance with the general duty provisions? What are you doing to clarify jurisdictional issues between EPA and DHS on chemical safety?

Answer: The EPA has taken numerous steps to assist sources with complying with the General Duty Clause. For example, the EPA published detailed guidance (*Guidance for Implementation of the General Duty Clause Clean Air Act Section 112(r)(1)*, May 2000) and a fact sheet on the Clean Air Act General Duty Clause (GDC). The guidance is primarily intended to assist the EPA inspectors in promoting compliance with the GDC. However, it is a public document that establishes the agency's expectations for compliance, and is therefore also useful to owners and operators of covered facilities in understanding their obligations under the GDC. The fact sheet provides owners and operators of stationary sources with information on GDC compliance and also refers readers to the guidance for more detailed information. The GDC guidance documents, fact sheets and numerous chemical safety alerts that promote awareness of chemical hazards and provide information on safety measures that facilities can take to control or mitigate hazards can be obtained from the EPA's website: www.epa.gov/emergencies/guidance.htm#rmp.

The EPA has the authority to issue regulations and implement programs intended to prevent accidental chemical releases, and to minimize the consequences of such releases under CAA section 112(r)(7). In addition, many federal agencies have important roles and have specific statutory responsibilities in chemical safety and security that may impact chemical plant security. The EPA is focused on the prevention of and the preparation for chemical accidents arising from natural disasters or technological failure while the Department of Homeland Security (DHS) is focused on addressing acts of terrorism or other security-related concerns. Other agencies, such as the Occupational Safety and Health Administration in the Department of Labor, also have a role in preventing chemical disasters impacting workers. Each agency, in the course of fulfilling its mandates, coordinates its actions when it impacts roles of other agencies so that the policies implemented are complementary as allowed under current law.

The Honorable Mark Takano (D-CA)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

Question 1: Thank you for your testimony before the House Committee on Science, Space and Technology on November 14, 2013. I appreciated learning more about your work at the Environmental Protection Agency, particularly your efforts to protect public health through enforcement of the Clean Air and Clean Water Acts.

On the Subject of clean water, I have additional questions pertaining to the proposed regulations that seek to clarity the bodies of water that should be subject to Clean Water Act jurisdiction. The EPA recently issues a draft scientific report on the connectivity of water, which remains under review by the Science Advisory Board. This report will serve as the scientific foundation for the proposed regulation.

As a member who represents a Southern California district, it is important that the members of the SAB who are putting together this report have an understanding of the water issues in the arid West. As you know, the water challenges and issues we face are vastly different from the Eastern and Midwestern parts of the U.S.

- What steps did the Agency take to ensure that the makeup of the SAB is "regionally" balances and more specifically, includes members who have a working understanding and knowledge of Western water issues?

Answer:

For the SAB Staff Office, a balanced committee or panel is characterized by inclusion of candidates who possess the necessary domains of knowledge, the relevant scientific

perspectives, and the collective breadth of experience to adequately address the Panel's charge. In forming the SAB Panel for the Review of the EPA Water Body Connectivity Report, the SAB Staff Office recognized the importance of selecting individuals who had knowledge of the connectivity of aquatic systems in different regions of the U.S. Therefore, a regionally balanced panel was selected. The Panel includes members who have knowledge of the connectivity of western aquatic systems and, in particular, arid west systems. Of the 27 individuals on the Panel, 3 are from the Northeast, 6 are from the South, 6 are from Midwest, and 12 are from the West. The expertise of the 12 members from western states is outlined below.

Dr. Allison Aldous, the Nature Conservancy

Dr. Aldous is a freshwater scientist with The Nature Conservancy in Portland, Oregon. She leads a major partnership between The Nature Conservancy and the U.S. Forest Service with the goal of improving the protection of groundwater-dependent resources on national forests across the U.S.

Dr. Lee Benda, Earth Systems Institute

Dr. Benda is a research geomorphologist at Earth Systems Institute in Mt. Shasta, California. He has been involved with the creation of NetMap, a community based system of tools and digital landscapes that provides consistent analytic stream layers and digital landscapes, coupled to analysis tools, across the western United States.

Dr. Kurt Fausch, Colorado State University

Dr. Fausch is a Professor in the Department of Fish, Wildlife, and Conservation Biology at Colorado State University in Fort Collins, Colorado. His research has focused on the importance of connectivity among critical habitats for fish in river hydroecosystems, and includes studies conducted throughout Colorado and the West, and worldwide.

Dr. Michael Gooseff, Colorado State University

Dr. Gooseff is an Associate Professor in the Department of Civil and Environmental Engineering at Colorado State University in Fort Collins, Colorado. He conducts research on stream-groundwater interactions.

Dr. Charles Hawkins, Utah State University

Dr. Hawkins is the Director of the Western Center for Monitoring and Assessment of Freshwater Ecosystems at Utah State University in Logan, Utah. He conducts research on the physical, chemical, and biotic condition of aquatic and riparian ecosystems.

Dr. Michael Josselyn, Wetlands Research Associates

Dr. Josselyn is a Principal with WRA, Inc. (Wetlands Research Associates) in San Rafael, California. He teaches an annual Wetland Delineator Certification course with a focus on arid west systems. He has completed wetland delineations in arid west systems including desert

dry washes, wet meadows in the Sierra Nevada Mountains, vernal pools in the Central Valley, and inland and coastal marshes.

Dr. Kenneth Kolm, Hydrologic Systems Analysis

Dr. Kolm is President/Senior Hydrogeologist and Hydrologic and Environmental Systems Specialist at Hydrologic Systems Analysis in Golden, Colorado. Dr. Kolm specializes in the fields of hydrogeology, geomorphology, and hydrologic and environmental systems analysis.

Dr. Mark Murphy, Hassayampta Associates

Dr. Murphy is a principal scientist at Hassayampta Associates in Tucson, Arizona. Dr. Murphy's research has focused on the connectivity in arid fluvial systems. He was a Principal Investigator for the Arid West Water Quality Research Project.

Dr. Duncan Patten, Montana State University

Dr. Patten is Director of the Montana Water Center and Research Professor with the Department of Land Resources and Environmental Sciences at Montana State University in Bozeman, Montana. He is also Professor Emeritus in the School of Life Sciences and past director of the Center for Environmental Studies at Arizona State University. His research interests include arid and mountain ecosystems, especially the understanding of ecological processes of riparian, wetland, and riverine ecosystems.

Dr. Jack Stanford, University of Montana

Dr. Stanford is the Director of the Flathead Lake Biological Station in Polson, Montana and is the Jessie M. Bierman Professor of Ecology at the University of Montana. He has conducted long-term studies in the Flathead River-Lake Ecosystem in Montana and British Columbia.

Dr. Maurice Valett, University of Montana

Dr.Valett is Professor of Systems Ecology at the University of Montana in Missoula, Montana. His research focuses on ecosystem ecology and biogeochemistry, nutrient retention in lotic ecosystems, groundwater-surface water exchange, floodplain river interactions, and wetlands and streams as flow-through systems.

Dr. Ellen Wohl, Colorado State University

Dr. Wohl is Professor of Geology in the Department of Geosciences at Colorado State University in Fort Collins, Colorado. Her research focuses on physical process and form in rivers, particularly headwater rivers, as these interact with ecological and human communities. She currently serves on the Grand Canyon Science Advisory Board.

Question 2: Recently, a document surfaces that appears to be the proposed water connectivity regulations that OMB is currently reviewing. If this is the proposed rule that was put forth by EPA and the US Army Corps of Engineers, it would appear that all tributaries will

be considered waters of the U.S. subject to regulations under the Clean Water Act. I have heard concerns that the language of the proposed rule could be broadly interpreted to encompass water conveyance and delivery systems.

- I have heard concerns that under the proposed rule it would be possible that the California Aqueduct and other features of California's vast water delivery system would be considered tributaries to be regulated under the Clean Water. Is that your understanding, how will it affect water delivery for tens of millions of Californians?

Thank you for your attention to my questions. I look forward to your response and continuing to work with you to protect our environment.

Answer: On March 25, the EPA and the U.S. Army Corps of Engineers released a proposed rule in order to provide additional clarity regarding the geographic scope of Clean Water Act jurisdiction and to improve national consistency and predictability. The comment period on the agencies' proposed rule will be open until October 20, 2014.

The agencies do not believe the proposed rule would change the jurisdictional status of water conveyance and delivery systems. However, the agencies look forward to further discussing the proposed rule with states and other stakeholders, including Western water utilities, to ensure that the agencies' rulemaking efforts provide greater clarity, preserve existing exemptions, and improve protections for our nation's waters. The agencies welcome comment on this issue, and the agencies will carefully consider such comments before publishing a final rule.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CONGRESSIONAL AND
INTERGOVERNMENTAL RELATIONS

The Honorable Lamar Smith
Chairman
Committee on Science, Space, and Technology
United States House of Representatives
Washington, DC 20515

Dear Chairman Smith:

Thank you for the opportunity to respond to the questions for the record from the House Committee on Science, Space, and Technology's hearing on November 14, 2013 entitled, ***Strengthening Transparency and Accountability within the Environmental Protection Agency.*** Please find our responses in the attached document.

Again, thank you for your letter. If you have further questions, please contact me, or your staff may call Christina J. Moody, in the EPA's Office of Congressional and Intergovernmental Relations, at (202) 564-0260.

Sincerely,

Nichole Distefano
Deputy Associate Administrator

Enclosure

cc: The Honorable Eddie Bernice Johnson
Ranking Member

Questions for the Record
U.S. House of Representatives
Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency
November 17, 2013

Questions from Lamar Smith

Hydraulic Fracturing Study Questions

Question 1: EPA's Hydraulic Fracturing Study is concerning because EPA is searching for what is possible without paying attention to what [is] probable. For example, the primary goals of the study are to answer questions such "What are the possible impacts of hydraulic fracturing fluid surface spills on or near well pads on drinking water resources?" It appears EPA's independent science advisors share this concern. For example, one SAB expert commented that "There is no quantitative risk assessment included in EPA's research effort. Thus, the reader has no sense of how risky any operation may be in ultimately impacting drinking water. This is also a significant limitation of the work."

Answer: Consistent with the scope defined by Congress in its request, the goal of EPA's report is to provide an assessment of the potential for hydraulic fracturing activities to impact the quality or quantity of drinking water resources in the United States. The goal of this report is to identify factors affecting the frequency and severity of impacts. EPA's report will represent a state of the science synthesis of information concerning the subject and will be national in scope. We did not conduct site specific or national predictive modeling to quantitatively estimate environmental concentrations of contaminants in drinking water resources. The report will not be a human health exposure assessment, it will not identify populations at risk, nor estimate human health impacts. The research approach was reviewed and supported by the EPA's independent Science Advisory Board. The findings from the study's individual research projects will be peer reviewed upon their individual completion. The study's assessment report has been designated a Highly Influential Scientific Assessment (HISA) and EPA is adhering to a rigorous, transparent peer review of the data and conclusions of the study. As a HISA, draft assessment will receive the highest level of peer review in accordance with EPA's Peer Review Handbook. The draft assessment report will be released for external, independent peer review by the Science Advisory Board (see http://www.epa.gov/hfstudy/peer-review.html).

Question 2: The Director of EPA's Office of Science Policy, Dr. Hauchman, stated in May 2012 that the Agency is implementing a "pretty comprehensive look at all the statutes to determine where "holes" may allow for additional federal oversight."
Is this study part of that comprehensive look? What statutes were looked at as part of this effort? What regulatory "holes" has EPA identified?

Answer: Dr. Hauchman was referring to the fact that the EPA is engaged in multiple activities related to hydraulic fracturing, not that the EPA is conducting a formal cross-statutory review. These activities are described on the EPA's web page: http://epa.gov/hydraulicfracturing.

Question 3: Given that there have been no proven instances of groundwater contamination, and that greenhouse gas emissions have actually declined thanks to natural gas, what problems are you seeking to solve?

Answer: The EPA is conducting this study in response to a request from Congress to investigate the potential impacts of hydraulic fracturing for oil and gas on drinking water resources. The study, which benefits from extensive stakeholder input and a scientific peer review by the Science Advisory Board, is designed to evaluate what impacts, if any, may be associated with each stage of the hydraulic fracturing water cycle. EPA is committed to studying and addressing potential concerns related to unconventional oil and gas development so that the public has confidence that it will proceed in a safe and responsible manner. In so doing, we will continue to follow a transparent, science-driven approach with significant stakeholder involvement.

Question 4: What has the Agency done to prevent repeating mistakes made in Parker County, Pavillion, and Dimock regarding fracking? Please include specific policy and protocol changes and actions taken.

Answer: In the three investigations referenced in your question, the EPA took action when the agency became aware of information indicating potential threats to human health. The EPA's actions generally focused on obtaining additional data and information in an effort to better understand and assess potential threats to public health and the environment. The agency consulted with its state and tribal partners prior to taking such measures and shared data and information with homeowners, the relevant state agencies, and where applicable, tribal authorities. In each case, the EPA relied upon sound science as it sought to provide clarity to these stakeholders and ensure that public health was protected, while working closely with individual states which have key regulatory authority relevant to unconventional oil and natural gas extraction. Beyond these instances, the EPA will continue to work with state partners and other stakeholders to study and address potential concerns related to unconventional oil and gas development so that the public has confidence that it will proceed in a safe and responsible manner.

The EPA is currently conducting a study to look at potential impacts of hydraulic fracturing across the nation. The agency's *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* is being conducted in accordance with the EPA Scientific Integrity Policy[1] and the principles laid out in the request from Congress.

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[1] U.S. EPA Scientific Integrity Policy, http://www.epa.gov/osa/pdfs/epa_scientific_integrity_policy_20120115.pdf

Question 5: Has EPA rescinded the draft Pavilion report and if the draft report has been removed from the hydraulic fracturing drinking water study and Scientific Advisory Board scope?

Answer: As you may be aware from our statement at the time of the State of Wyoming's announcement on June 20, 2013, we believe that the EPA's focus should be on using our resources to support Wyoming's efforts, which will build on the EPA's monitoring results. In light of the State's commitment to further investigation and efforts to provide clean water to Pavillion residents, the EPA does not plan to finalize nor seek peer review of its draft report.

EPA Region 8 maintains a website (http://www2.epa.gov/region8/pavillion) with information about the Pavillion investigation. It includes a chronology of events and hyperlinks to relevant information and reports dating back to August 2009. This chronology includes information regarding the June 2013 announcement that Wyoming would further investigate drinking water quality in the area east of Pavillion. Region 8 will continue to update its website to include additional milestones reached by the State, including a link to the Wyoming Oil and Gas Conservation Commission (WOGCC) website (http://wogcc.state.wy.us/pavillion_wrk_grp.cfm) where the State's August 5, 2014 Well Integrity Review draft report and Appendices can be found.

Question 6: In addition to the retrospective and prospective case studies, it is our understanding that there are 18 additional research projects that EPA had undertaken to help answer the secondary research questions of the study.

- How is EPA conveying the information from these projects to the public?

Answer: The EPA is fully committed to sharing information with the public about our research projects and our findings. The agency has held numerous public information sessions, workshops, roundtables, and webinars to update interested stakeholders about our research activities, and we have posted extensive information on the study website. Externally peer reviewed papers associated with the EPA research projects have been posted and, as papers are peer reviewed and completed, will be posted on the agency's website. Papers that have already undergone peer review can be found at: http://www2.epa.gov/hfstudy/published-scientific-papers.

- Will details be posted on the study website?

Answer: Yes, the website is regularly updated with study updates, meeting materials, published papers, and opportunities for participation.

- What is the plan for peer review of the completed projects?

Answer: Results from individual research projects ndergo peer review prior to publication either as articles in scientific journals or as EPA reports. Each project was reviewed, consistent with OMB's Bulletin on Peer Review, to determine the appropriate level of peer review. Furthermore, articles submitted to journals will be reviewed according to the journals' peer review process, external to the EPA. Projects written up as the EPA reports will undergo contractor-led peer reviews.

- What is the role of the SAB Hydraulic Fracturing Research Advisory Panel with respect to these projects and their final reports?

Answer: The SAB Hydraulic Fracturing Advisory Panel, which is an ad hoc panel of independent experts under the auspices of the SAB, is providing periodic advice and review of the EPA's hydraulic fracturing research. In May 2013, the panel reviewed the study's Progress Report and offered the public an opportunity to provide oral and written comments for consideration by the individual panel members. The EPA is considering the individual panel experts' comments in the development of the draft hydraulic fracturing drinking water assessment report, which will be released for public comment and a formal SAB peer review.

The Panel will review the draft hydraulic fracturing assessment report and will not peer review EPA's separate research projects. EPA's individual research projects will be reviewed consistent with the OMB's Bulletin on Peer Review prior to inclusion in the assessment report, as described in more detail above.

- What is the role of the SAB Hydraulic Fracturing ad hoc panel?

Answer: The answer to the previous question, see above.

The SAB Hydraulic Fracturing ad hoc panel will review the EPA assessment report on the potential impacts of hydraulic fracturing for oil and gas on drinking water resources. This assessment report has been designated as a highly influential scientific assessment (HISA. The Panel will receive an update from ORD on its study of the potential impacts of hydraulic fracturing for oil and gas on drinking water resources during a public teleconference prior to the release of the draft assessment report for formal SAB peer review and public comment.

- What is the ad hoc panel's review schedule for the remainder of the study?

Answer:

The EPA plans to brief the SAB ad hoc panel on the progress of research prior to the release of the draft assessment report for formal SAB peer review and public comment.
The EPA is considering the individual panel experts' comments on the progress report in the

development of the draft hydraulic fracturing drinking water assessment report. Our current timeline for release of the study for public comment and a formal SAB peer review is early 2015.

Question 7: Is EPA planning to release the raw data from the five Retrospective case study sites to the public via the study website? If so, when will that be available and will the needed context be included when released?

Answer:
Yes. The data and the five retrospective case study reports will be posted on the study website following peer review and report completion.

Question 8: Have states been forthcoming with data under current Request for Information on the September 2012 study? If not, how have you reached out to these states, particularly those states where a retrospective case study is located?

Answer: State input has played an important role in the development and execution of the *EPA's Study of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources*. During the development of the study plan, the agency held webinars and in-person public informational meetings in Texas, Colorado, Pennsylvania, and New York to obtain feedback on the EPA's proposed activities. In the execution of the study, the agency coordinated with states on research conducted in the field, including the retrospective case studies, and in the analysis of data obtained from the states. Webinars, technical roundtables and workshops, requests for information through the *Federal Register*, and public comment periods associated with the SAB review of the Progress Report continue to provide states and other stakeholders with information updates and opportunities for input on the agency's hydraulic fracturing research activities. We have recently intensified our state outreach efforts as part of the study. These efforts will ensure that states understand the data sources we used, and will provide them further opportunity to recommend additional sources of information. Moving forward, the EPA will continue to engage with the states.

Question 9: Has the EPA done any testing in real time for sites that are currently being developed? If not, does the agency plan to do testing in real time at any sites?

Answer: We have worked closely with industry partners to try to identify suitable locations for prospective case studies that meet the scientific needs of the study and industry's business needs. We continue to explore opportunities and so far we have not identified a suitable location. For a location to be suitable, it is necessary to gather a minimum of one year of characterization data for ground water and surface water prior to and following unconventional exploration activities in the study area, and for there to be no other hydraulic fracturing activities on adjacent properties during the entire study period, which could last several years.

Question 10: What has been your work with DOE and USGS to date on the study?

Answer: The EPA, DOE, and USGS routinely exchange information regarding ongoing and planned research. Exchanges among principal investigators, in addition to high level discussions, help to assure that information about the research, relevant papers, models, and data are shared and can be used to inform work underway by others. In addition to these consultations, as part of the study's research project on Subsurface Migration Modeling, the EPA is working with DOE's Lawrence Berkeley National Laboratory to explore the potential for hydraulic fracturing fluids to move from the fractured zone to drinking water resources.

Question 11: How are you accounting for fracturing technology innovations as part of the study?

Answer: To ensure that the EPA is up-to-date on evolving hydraulic fracturing practices and technologies, the agency requested relevant data and scientific literature to inform the study through a *Federal Register* Notice. The EPA has solicited relevant information from experts and the public through ongoing stakeholder engagement activities. More than 100 experts participated in a series of technical workshops EPA held in 2013 to engage stakeholders and solicit information regarding technology innovations. In November 2013, the Science Advisory Board held a meeting and specifically requested input regarding technology innovations. The agency is also conducting a comprehensive literature review that will contain the most recent technical information regarding developments in hydraulic fracturing.

Question 12: Do you believe hydraulic fracturing can be performed in a safe and responsible manner?

Answer: Responsible development of America's unconventional oil and natural gas resources offers important economic, energy security, and environmental benefits. The EPA is committed to studying and addressing potential concerns related to unconventional oil and natural gas development so that the public has confidence that it will proceed in a safe and responsible manner. In so doing, we will continue to follow a transparent, science-driven approach with significant stakeholder involvement.

Question 13: Could you tell us what plans the EPA has for addressing methane- particularly in regards to midstream and upstream systems?

Answer: In support of the Administration's Strategy to Reduce Methane Emissions, EPA released a series of five white papers on potentially significant sources of volatile organic compound (VOCs) and methane in the oil and gas sector for input from a panel of independent experts. The white papers focus on technical issues covering emissions and mitigation techniques. EPA will use the papers, along with input from the experts and technical input and data from the public to determine how to best pursue further reductions

from these sources. The papers do not draw policy conclusions.

Question 14: If the EPA sets a lower NAAQS of 60 to 70 parts per billion for ozone, do you believe there will be parts of the country that cannot meet the new standard due to background concentrations of ozone? If so, what would be the economic and regulatory consequences for a state that cannot meet the new standard?

Answer: Our modeling suggests that mean background ozone levels over the U.S. are approximately 25-45 ppb and that the upper end of background levels (i.e., 95th percentile) are less than 55 ppb even at the sites most influenced by background such as high-elevation sites in Western US. We don't expect there to be parts of the country that couldn't attain a lower NAAQS level of 70 or 60 ppb solely due to background. EPA is currently working on the revised ozone standard and has not made a decision yet about what standard it will propose.

By law, the EPA must set the ozone national ambient air quality standards (NAAQS) at a level to protect public health, regardless of where the ozone originates. However, the EPA does not expect states to limit naturally occurring ozone or ozone formed from emissions outside their jurisdiction. The Clean Air Act contains provisions that facilitate excluding high ozone values that meet the definition of exceptional events (section 319), and attainment planning provisions that do not penalize states if attainment is not possible due to international influences (section 179B).

Question 15: Is it fair for the EPA to include Mexican and Canadian emissions in its background estimates when the states will be forced to control for international ozone emissions?

Answer: States will not be forced to control for ozone formed from emissions outside their jurisdiction, including ozone formed from international emissions. The Clean Air Act contains provisions that facilitate excluding high ozone values that meet the definition of exceptional events (section 319), and attainment planning provisions that do not penalize states if attainment is not possible due to international influences (section 179B).

In the current NAAQS review, the EPA will be providing estimates of "U.S. background" which assumes that Canada and Mexico are part of the background and therefore not part of the controllable emissions.

General Air Pollution/NAAQS

Question 16: Considering the limits of science and technology, what is EPA's strategy for working within the framework established by Congress to effectuate the NAAQS?

Answer: As required by the Clean Air Act, the EPA reviews the NAAQS on a 5-year cycle.

After considering the body of scientific evidence on the effects of air pollution on public health and welfare, the agency determines whether the current standards provide an adequate level of protection for public health and welfare or whether the standards should be revised to meet the requirements of the Act. After a standard is set, the EPA works with state, local and tribal partners to implement it.

Question 17: Because of many factors, such as regulatory uncertainty, the funding for and construction of new long-term, base load power is dwindling. How do you balance new regulations that may benefit human health and the environment via decreased emissions against increased energy costs and the possibility of increased blackouts –both of which have a negative impact on human health?

Answer: For 40 years, we have been able to both implement the Clean Air Act and keep the lights on. We don't intend to change that. As you note, the changes in the power sector are driven by several factors. However, many experts, including the Energy Information Administration and Congressional Research Service, agree that the primary driving factor influencing power sector business decisions is low natural gas prices. The EPA works with power sector stakeholders as we develop our policies to identify challenges and provide flexibilities as appropriate to make compliance easier and less expensive. We work with utilities, system operators, state and federal regulators as these stakeholders work together to address local reliability. Although the EPA, as required by the Clean Air Act, does not take costs into account in setting the NAAQS, the EPA does examine the health and environmental benefits and economic impacts of its regulations, including analysis of energy prices and output, changes in electricity generation mix, impacts on reserve margins for reliability, and other energy-related metrics. For example, analyses by the EPA and the DOE on the EPA's Mercury and Air Toxics Standards (MATS) indicate that there will be more than enough electric generating capacity to meet the nation's needs. Meanwhile, the human health benefits from air quality improvements due to MATS implementation totals up to $90 billion each year. Additionally, looking at fossil generation greater than 250 MW that is currently being developed, approximately 6 GW of new capacity is expected to come online in 2015, which is higher than the average for the 2000s (NEEDS 5.13).

Question18: What is your vision to address international transport and what is your plan for equipping states to address these issues?

Answer: The EPA continues to evaluate the international transport of air pollution to ensure that we fully understand and appropriately account for the impacts of this pollution in developing efficient and effective programs for meeting national air quality health standards. To date, science shows that international transport of air pollution can affect air quality in the U.S. at different times and in different locations. However, studies show that domestic sources of emissions are the primary cause of the ambient concentrations of criteria pollutants in the U.S.

The EPA does not expect states to limit naturally occurring ozone or ozone formed from

emissions outside their jurisdiction when implementing the NAAQS. The Clean Air Act contains provisions that facilitate excluding high ozone values that meet the definition of exceptional events (section 319), and attainment planning provisions that do not penalize states if attainment is not possible due to international influences (section 179B).

Question 19: Do you believe EPA has legal authority to require changes from other nations in order to address international transport?

Answer: The EPA does not have legal authority to require changes from other nations in order to address international transport except as provided in international agreements. The EPA has worked successfully with Canada under the U.S.-Canada Air Quality Agreement (1991) and with Mexico under the U.S. – Mexico La Paz agreement (1983) to reduce transboundary air pollution affecting the U.S. In addition, the EPA works with other nations under multilateral environmental agreements that address international air pollution transport including the Convention on Long Range Transboundary Air Pollution, and will do so under the newly established Minamata Convention on Mercury when it enters into force. Another multilateral environmental agreement under which we could work with other nations to address international air pollution is the Stockholm Convention on Persistent Organic Pollutants, signed in 2001, for which implementing legislation and Senate advice and consent is pending. The EPA also works with other nations through Annex VI to the International Convention for the Prevention of Pollution from Ships to address air pollution transport from international shipping. In addition, the EPA has been collaborating with China for over a decade to exchange best practices for understanding and addressing air pollution. This cooperation is giving China technical and policy tools and approaches to help them reduce pollution from power, industrial and transportation sources, thereby reducing pollution that contributes to international transport.

Question 20: What is EPA's plan to address the imbalance created via the adoption of standards and requirements without the tools necessary to demonstrate compliance?

Answer: Although courts have recognized that EPA is not legally required to issue implementation guidance when adopting new or revised standards, EPA customarily evaluates the need for any such additional guidance or implementation rules as a matter of discretion. For example, EPA will often issue an implementation rule and, as appropriate, policy and/or technical guidance that, for example, describes the designations process and schedule, requirements for PSD and NSR programs, and process and schedule for submitting approvable State Implementation Plans. We also provide guidance to address state-specific or source-specific implementation issues that are brought to our attention. Finally, as we did in the 2012 $PM_{2.5}$ NAAQS final rule, we consider whether to include grandfathering provisions to facilitate a smooth transition to any new or revised standards that would apply to permitting for major sources in attainment areas.

Question 21: Is it possible to propose and adopt a new standard and the implementation rule and/or guidance at the same time? If so, can you commit to adopting the new standard and

the implementation rule and/or guidance at the same time? Why or why not?

Answer: In cases where there may be novel issues raised by the adoption of a new or revised national ambient air quality standard, the EPA's goal is to provide timely updates as necessary to address these issues in rules and guidance to implement the new or revised standards. Only certain Clean Air Act requirements demand compliance at the same time as a new standard is adopted (e.g., new source preconstruction permit requirements that apply in attainment areas), and the EPA's goal is to assess what is needed and provide the appropriate updates to rules, tools, and guidance to address those immediate compliance requirements within the same timeframe that the standard is adopted. For Clean Air Act requirements that do not demand compliance for several years after a new standard is adopted, the EPA's goal is to assess and provide any necessary guidance at a reasonable time in advance of the compliance deadline.

Question 22: Does EPA have any plans for addressing methane -particularly in regards to midstream and upstream oil and gas production?

Answer: On March 28, 2014 the Obama Administration released the Climate Action Plan: a Strategy to Reduce Methane Emissions. The strategy summarizes the sources of methane emissions, commits to new steps to cut emissions of this potent greenhouse gas, and outlines the Administration's efforts to improve the measurement of methane emissions. The strategy builds on progress to date and takes steps to further cut methane emissions from several sectors, including the oil and natural gas sector.

As one of those steps, EPA on April 15, 2014 released for external peer review five technical white papers on potentially significant sources of emissions in the oil and gas sector. The white papers focus on technical issues covering emissions and mitigation techniques that target methane and volatile organic compounds (VOCs). The peer review was completed June 16, 2014. As noted in the Obama Administration's Strategy to Reduce Methane Emissions, EPA will use the papers, along with the input we received from the peer reviewers and the public, to determine how to best address emissions from these sources.

This fall, EPA will determine what if any regulatory authorities, including setting standards under section 111 of the Clean Air Act or issuing Control Techniques Guidelines under section 182 of the Act, the agency will apply to emissions from these sources. If EPA determines to follow a regulatory course of action, it will undertake a schedule that will ensure that both rulemaking and any ensuing regulatory requirements for the states are completed by the end of 2016. The white papers as well as the peer review comments are available at: www.epa.gov/airquality/oilandgas/whitepapers.html

Another key step in the Obama Administration's Strategy to Reduce Methane Emissions, is the bolstering of EPA's voluntary Natural Gas STAR Program. The program has already identified more than 50 cost-effective technologies and practices that reduce or avoid methane emissions in the oil and natural gas sectors, by eliciting more robust industry commitments while

enhancing transparency and accountability. In the spring of 2014, EPA began to engage the industry, states, and other key stakeholders on ways to enhance this program, and will formally launch the new partnership by the end of 2014.

Environmental Health Claims

Question 23: EPA estimates that reductions in particulate matter (PM) will prevent 230,000 to 490,000 early deaths making PM exposure between the first to third highest risk factor for mortality in the U.S. in 2020. Will you commit to reviewing these analyses with the CDC and other health agencies to get support for these claims?

Answer: The EPA estimated that the Clean Air Act (CAA) Amendments of 1990 would prevent over 230,000 early deaths in 2020 with a 95th percentile confidence interval of 45,000 to 490,000 early deaths. Most of these early deaths are associated with reduced exposure to fine particles, including precursor pollutants such as sulfur dioxide that form fine particles in the atmosphere. These estimates are relative to a hypothetical baseline scenario without the 1990 Amendments and related programs. The EPA report received extensive review and input from the Council on Clean Air Compliance Analysis, an independent panel of distinguished economists, scientists and public health experts established by Congress in 1991.

The report is the third in a series of the EPA studies required under the 1990 Clean Air Act amendments that estimate the benefits and costs of the act. The reports are intended to provide Congress and the public with comprehensive, up-to-date, peer-reviewed information on the Clean Air Act's social benefits and costs, including improvements in human health, welfare, and ecological resources, as well as the impact of the act's provisions on the U.S. economy. More information and a copy of the report: http://www.epa.gov/air/sect812/prospective2.html

In addition, the peer-reviewed study, *The State of US Health, 1990-2010: Burden of Diseases, Injuries, and Risk Factors* concluded that ambient particulate matter pollution remains one of the top 10 health risk factors in the U.S. The study published in the Journal of the American Medical Association included co-authors from many health agencies. A copy of the study: http://jama.jamanetwork.com/article.aspx?articleid=1710486

New Source Performance Standards for Power Plants

Question 24: In a memo to the broader Science Advisory Board on Nov. 12, the SAB Work Group charged with reviewing the EPA's major rulemaking actions recommended a review of science underpinning the NSPS proposal. Specifically, the Work Group highlighted concerns that the underlying science lacked adequate peer review. Subsequently, at a SAB board meeting Dec. 4-5, the EPA representatives argued against the Work Group's recommendations. In light of these developments, we respectfully request that you make available to the Committee the following information:

- All written communications between those EPA employees the SAB or the SAB Work Group concerning peer review of any studies that the proposed standards relied

on.

Answer: With regard to your request for written communications, EPA staff informs me that the appropriate protocol is to make such a request through a separate letter to the agency. EPA will respond appropriately to any such request.

- A record of all peer review of any studies that the proposed standards relied on.

Answer: The EPA provided some additional information to SAB on the basis of the DOE NETL cost studies that the EPA used in developing the proposed rule and the peer review process followed by DOE NETL for that study. The DOE's robust process included outside input from knowledgeable stakeholders including industry, academia and government experts in the design of the study and a peer review of the final report by a wide range of similar experts. The documents provided to SAB are attached:
"FY05+NETL+Merit+Review+Final+Report+1217.pdf" and
"NETL+Review+comments+on+cost+&+Performance+fossil+EGU.pdf"

- EPA's intentions regarding the need for further peer review of any such studies and whether EPA intends to withdraw its reliance on any of those studies in promulgating the performance standards.

Answer: While the EPA did not conduct additional peer review of the DOE NETL cost studies, the different levels of multi-stakeholder technical input and final review meet the requirements to support the analyses as defined by the EPA Peer Review Handbook.

After consideration of the clarifying information and thorough discussion about the issues during several meetings of the SAB that were open to the public, the workgroup recommended to the full SAB that additional review of the science of sequestration was not necessary in the proposed Carbon Pollution Standard. The full SAB agreed with the workgroup's assessment that the proposed Carbon Pollution Standards rely on existing requirements for sequestration and that peer review of the DOE cost studies was sufficient. In a memo dated January 29, 2014, the SAB informed the EPA that it will not undertake further review of the science supporting this action.

- All records of any SAB or the SAB Work Group review of or input into the proposed standards. If EPA did not solicit this input, please explain why not.

Answer: The SAB convened a Work Group to consider the science supporting actions identified in the Spring 2013 Unified (Regulatory) Agenda and Regulatory Plan and requested the Work Group to provide the SAB with a report on these considerations. As part of that activity the Work Group and the SAB considered whether to review the science supporting any of the planned regulatory actions in that agenda in order to provide advice and comment on the adequacy of the science, as authorized by section (c) of the Environmental Research, Development and Demonstration Authorization Act. This activity included

consideration of the Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units (2060-AQ91).

With regard to your request for records, EPA staff informs me that the appropriate protocol is to make such a request through a separate letter to the agency. EPA will respond appropriately to any such request.

- EPA's intentions regarding future SAB or SAB Work Group input into the proposed standards. If EPA does not intend to solicit this input, please explain why not.

Answer: As noted above, the full SAB agreed with the workgroup's assessment that the proposed Carbon Pollution Standards rely on existing requirements for sequestration and that peer review of the DOE cost studies was sufficient. In a memo dated January 29, 2014, the SAB informed the EPA that it will not undertake further review of the science supporting this action.
With respect to the existing geologic sequestration regulations, the EPA will continue to monitor technological progress on geologic sequestration as those regulations, which contain specific monitoring and operational requirements, are implemented. The EPA also will continue to work with other agencies, researchers, and industry to ensure that our regulations are based on the best available science. The EPA plans to provide a briefing on these activities and periodically update the SAB on the status of its geologic sequestration regulations, ongoing permitting, and collaboration with DOE and other agencies.

- All records of any SAB or SAB Work Group input into EPA's development of regulations under Section 111(d) of the Clean Air Act pertaining to existing fossil-fuel-fired electric generating units or SAB or SAB Work Group consideration of such regulations.

Answer: The SAB did not provide advice or comment to the EPA for the development of a proposed rule for the Greenhouse Gas Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (2060-AR33). The SAB convened a Work Group to consider the science supporting actions identified in the Spring 2013 Unified (Regulatory) Agenda and Regulatory Plan and provide the SAB with a report on these considerations. As part of that advisory activity the Work Group and the SAB considered whether to review the science supporting any of the planned regulatory actions in that agenda in order to provide advice and comment on the adequacy of the science, as authorized by section (c) of the Environmental Research, Development and Demonstration Authorization Act. This activity included consideration of the Greenhouse Gas Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (2060-AR33). With regard to your request for records, EPA staff informs me that the appropriate protocol is to make such a request through a separate letter to the agency. EPA will respond appropriately to any such request.

- EPA's intentions regarding future SAB or SAB Work Group input into these existing unit regulations. If EPA does not intend to solicit this input, please explain why not.

Answer: The EPA has engaged in, and continues its engagement with a broad range of stakeholders about the proposed Clean Power Plan to ensure it is informed by a full range of perspectives, technical information and other information relevant to the proposal. . EPA recently informed the SAB of this rule and the Agency's technical approach and the SAB determined that the science supporting this action did not require further peer review.

Question 25: Since EPA claims no one is expected to build a new coal plant in the near future, could EPA wait 8 years until the next review of NSPS to allow greater time for determination as to whether CCS is adequately demonstrated for new coal plants? If so, why does EPA see the need to determine whether CCS is adequately demonstrated before this time, seeing as no NGU's will be built before then?

Answer: The EPA is setting a source category limit as authorized by CAA Sec 111(b). The CAA requires the EPA to identify the "best system of emission reduction ... adequately demonstrated" (BSER) available to limit pollution – and set an emission standard based on that analysis. After analyzing the factors that make up BSER, we proposed to determine that partial CCS is the BSER for new coal-fired EGUs. As discussed in the preamble for the proposed rule, 79 FR at 1462, the Act and subsequent court decisions identify factors for the EPA to consider in a BSER determination including: (1) the technical feasibility, (2) the reasonableness of the costs, (3) the promotion of advanced technology, and (4) the size of emission reductions. After reviewing many reports, studies, projects, and stakeholder input EPA proposed to determined partial capture of CO2 best meets the requirements for BSER and is consistent with a number of projects currently under development. When finalized, the proposed standards will provide those generators that may choose to build new coal-fired capacity with certainty as to the facilities GHG obligations.

Economic Modeling Commitment

Question 26: Since 1977, section 321 (a) of the Clean Air Act (CAA) has required "the Administrator to conduct continuing evaluations of potential loss of shifts of employment which may result from the administration or enforcement of the provision of [the Clean Air Act] and applicable implementation plans, including where appropriate, investigating threatened plant closures or reductions in employment allegedly resulting from such administration or enforcement." The #321 requirement is different than the requirement from Executive Order 12866 that EPA consider in a Regulatory Impact Analysis (RIA) what impact a single proposed rule will likely have on jobs. For S321, EPA has to consider the impact that existing CAA requirements – taken as a whole- have had on job losses and shifts in employment throughout our economy. RIA's, by contrast, only consider the potential future employment impact that a single proposed rule will have. Therefore, EPA's preparation of RIA's for new rules does not satisfy S321 (a). EPA has never conducted a section 321 (a) study to consider the impact of CAA programs on jobs and shifts in employment.

Why has EPA not conducted a study to consider the impact of CAA programs on job shifts and in employment?

Will EPA commit to conducting such studies in the future?

Answer: The EPA has found no records to indicate that CAA section 321, since its inclusion in the 1977 amendments, has been interpreted by any Administration to require job impacts analysis of rulemakings or job impacts analysis of existing CAA requirements as a whole. Section 321 does provide a mechanism for the EPA investigation of particular claims of job loss related to plant closure or layoffs in response to environmental regulation or enforcement actions. In addition, the EPA performs detailed regulatory impact analyses (RIAs) for each major rule it issues, including cost-benefit analysis, various types of economic impacts analysis, and analysis of any significant small business impacts. Since 2009, the EPA has focused increased attention on consideration and (where data and methods permit) assessment of potential employment effects as part of the detailed RIAs conducted for each major rule. EPA has found that existing methods for assessing employment effects of economically significant regulations have significant limitations and weaknesses, and has been transparent about these limitations and weaknesses as it has explored alternate approaches for better understanding these effects. With this caveat, the EPA analyses, consistent with current literature, have generally found that environmental regulations may have both positive and negative effects on jobs but that these effects tend to be relatively small and difficult to quantify with any precision. This is consistent with data from the Bureau of Labor Statistics that indicate labor markets are primarily influenced by other, larger factors including routine business cycles, changes in production technology, and the state of the overall economy. Nevertheless, the EPA continues to explore and evaluate potential tools, data, and methodologies that could expand and improve assessments of the effects of our programs, including effects on labor markets. We will continue to comply with statutory and administrative requirements for analysis of our programs in a manner consistent with principles of sound science and economics.

Question 27: EPA committed to convene an independent panel of economic experts experienced with "whole-economy" modeling to evaluate whether EPA's current economic modeling adequately measures the employment impacts of rules. Why has the EPA not convened such an independent panel? Does EPA have plans of convening this panel in the future? If so, when?

Answer: Last year, Acting Administrator Perciasepe sent a memo to the EPA's Science Advisory Board (SAB) Office asking it to convene a new expert panel on economy-wide modeling. Following typical procedures for this type of panel, EPA's Office of Policy and Office of Air and Radiation released a set of draft charge questions and an analytic blueprint for public comment in February 2014. The comment period closed on April 7, 2014. The SAB Office recently published a Federal Register Notice soliciting nominations of experts for the panel, which closed on May 21, 2014. The list of candidates was posted on the SAB website on

July 7, 2014 for comment, and EPA expects that the SAB Office will be able to formally convene a panel by Fall of 2014."

Sue and Settle

Question 28: During Senate confirmation as EPA Administrator on July 9, 2013, you agreed to undertake four actions items: (1) improve Freedom of Information Act (FOIA) training for EPA employees, (2) publicly release the scientific information EPA used to set nationwide air quality standards, (3) study whether EPA needs to conduct more through economic analyses of the employment impacts of its regulations, and (4) to publish on two websites the Notices of Intent to Sue (NOIs) and Petitions for Rulemaking (PFRs) received by the agency.

- What steps have you taken since your confirmation to improve the transparency of this process and allow affected parties, including states and industry, to participate in the process, including settlement negotiations, to ensure that all interests are represented?

- As EPA Administrator, what steps are you taking to ensure that the agency does not agree to deadlines through settlements that do not provide sufficient time for EPA to meet its obligations under the Administrative Procedure Act, the Regulatory Flexibility Act, the Small Business Regulatory Enforcement Fairness Act, OMB Circular A-4, and other requirements that apply to EPA?

Answer: The EPA has made a concerted effort to provide additional information to stakeholders, and to seek input widely on EPA actions. For example, as the Agency works to develop the proposed carbon pollution standards for existing power plants, the process of engagement with states, stakeholders, and the public has been extensive, and stakeholders all over the country have taken advantage of the opportunities provided.

With respect specifically to lawsuits, the EPA has continued to expand its website providing Notices of Intent to Sue, and has begun posting copies of complaints when one associated with a posted notice is filed. http://epa.gov/ogc/noi.html.

Most of the EPA settlements are under the Clean Air Act; most of these agreements are published in the Federal Register for public comment, and all comments are considered before the agreement is finalized.

The EPA does not and will not commit in any settlement agreement to any final, substantive outcome in a rulemaking or other decision-making process. The EPA settlements do not impair notice-and-comment rulemaking rights. In any settlement, it is the EPA's priority to secure enough time to allow for an appropriate decision-making process, including appropriate public input and participation. All interested parties are provided opportunities for comment on proposed rules, and comments submitted are carefully considered and often significantly shape the final rule.

Question 29: In a denial earlier this year of several environmental groups' petition for a rulemaking under the Clean Air Act, Acting Administrator Robert Perciasepe stated that, "[e]ven under the best circumstances, the EPA cannot undertake simultaneously all actions related to clearly determined priorities as well as those requested by the public, and so the agency must afford precedence to certain actions while deferring others... The EPA must prioritize its undertakings to efficiently use its remaining resources."

In your view, do new commitments that EPA agrees to in "sue and settle" agreements with environmental groups, including timetables for rulemaking, have an impact on EPA's priorities as to the rulemakings that it undertakes? Have they had an impact on EPA's budgetary resources?

Answer: The EPA is frequently sued by stakeholders, including industry, environmental groups, and state and local governments. Litigation is adversarial by nature: It is never EPA's preference to be sued, and the Agency is not complicit in such lawsuits. While the EPA litigates most of these suits to final judgment, the EPA, much like its sister agencies throughout the Federal Government, has a longstanding practice of entering into settlements in lieu of resource-intensive litigation where, in the judgment of the Agency and its representatives at the United States Department of Justice (DOJ), it would be in the interest of the Agency and in the interest of the public to pursue settlement. Each settlement agreement is the result of a negotiation between opposing parties, with DOJ representing the EPA and the interests of the United States.

Litigation can certainly be expensive, and as such can have an impact on the EPA's resources. Settlements, however, generally save the Agency (and the taxpayer) money.

The large majority of the EPA settlements occur in cases where the complaint alleges the EPA has failed to meet a mandatory duty it is obligated to perform under federal law. In well-grounded mandatory duty lawsuits, seeking settlement is the most responsible course of action. The alternative would involve engaging in expensive litigation with the expected outcome of a court-ordered schedule likely to require agency action on a less feasible timeline, with an increased risk of higher fees and costs.

Tier 3

Question 30: Did EPA proceed with the Tier 3 rule to satisfy an agreement during the CAFÉ negotiations?

Answer: No.

Integrated Risk Information System

Question 31: IRIS assessments released at the evidence table stage come without context

and the public lacks knowledge regarding EPA thoughts regarding endpoints of concern, modeling and critical literature. As such, within just 60 days, the public must review hundreds of studies to provide comments to EPA on their quality, acceptability and suggested use. This may be placing a heavy burden on stakeholders who wish to engage the EPA. Do you believe changes could be made to this approach that might benefit stakeholders? If so, what changes do you think stakeholders might benefit from most?

Answer: Stakeholder engagement is very important to the IRIS Program, and the EPA was responsive to stakeholder suggestions in designing enhancements to the IRIS Program (announced in July 2013). Small adjustments may become necessary as we move forward to implement the enhancements. For example, in December 2013, we held our first IRIS bimonthly public meeting to discuss: 1) early materials (literature search, evidence tables, and exposure-response figures) for chemicals being assessed through the IRIS Program; and 2) draft assessments and draft peer review charges. In response to comments heard at the December bimonthly public meeting, we are providing information to all stakeholders that will make it possible for anyone to participate early in the assessment development process, prior to IRIS Program decisions regarding hazard identification and dose-response assessment. Some specific changes in our approach, designed to better facilitate participation and discussion, are already occurring through changes to our IRIS bimonthly public meetings and preliminary material releases (e.g., diethyl phthalate and hexabromocyclododecane). These improvements have been recently announced on the IRIS website (www.epa.gov/iris) and include the following additional materials:

- Sections of the assessment on scope and problem formulation that explains why EPA is interested in conducting an assessment and provides some background information on the chemical, its predominant uses, and the pathways through which humans can be exposed.
- The initial literature search strategy and the results of the literature search.
- Evidence tables that summarize key information on the design and results of pertinent scientific studies. Studies with serious flaws according to criteria discussed in the EPA's guidelines (and summarized in the draft Preamble to the IRIS Toxicological Review) are excluded. If additional selection criteria were applied to facilitate a more efficient review of the evidence (for example, to highlight the most informative studies when there are a large number of studies on an effect), these criteria are explained in text accompanying the evidence tables.
- Some key science issues that will be considered in the development of future assessments.

As the IRIS program continues to evolve, the EPA is committed to evaluating how well our approaches promote constructive public discussion with our stakeholders as well as reviewing how our approaches can more effectively facilitate subsequent assessment development.

Question 32: EPA has released a complete draft benzo[a]pyrene assessment for 60 day

peer review. Upon request, EPA did extend the comment period for another 30 days. However, the document and supporting information is over 500 pages and the public did not benefit from any review of evidence tables. There were no earlier discussions with EPA about critical studies. Why didn't EPA share some of the preliminary information with the public before releasing a completed draft assessment?

Answer: When the IRIS Program announced the enhancements in July 2013, there were IRIS assessments in different stages of development. For example, some assessments were in the early stages of development, some were nearly ready to publicly release in draft form, and some were in the latter stages of development. Therefore, the degree to which the enhancements are being applied for a particular assessment varies and depends on the step an assessment was in when the IRIS enhancements were announced. The draft benzo[a]pyrene assessment was nearly complete when we announced the enhancements to the IRIS Program in July 2013 – thus, we released the draft assessment for public comment in August 2013. During the December 2013 IRIS bimonthly public meeting, we had a robust discussion with stakeholders about the draft benzo[a]pyrene assessment. We are revising the draft assessment based on the public comments we received and the discussion we had during the December meeting. We will release a revised draft assessment for peer review in the near future.

Question 33: Will you ensure that as part of the improvements in the IRIS program, the Agency will move away from outdated default assumptions and instead always start with an evaluation of the data and use modern knowledge of mode of action – how chemicals cause toxicity – instead of defaults?

Answer: In developing an IRIS assessment, the EPA looks at all of the available data, including information about mode of action. We look at the entire database of scientific information, and we systematically review that information to develop the assessment. For example, consistent with the Agency's *Guidelines for Carcinogen Risk Assessment*, the EPA considers a critical analysis of all relevant information as the starting point from which a default option may be invoked if needed to address uncertainty or the absence of critical information. Examples of the EPA's other guidelines that include information on default approaches include the Benchmark Dose Technical Guidance (US EPA, 2012) document and the Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (US EPA, 2005). These guidelines and others are available at http://www.epa.gov/iris/backgrd.html. The EPA is committed to using sound science and continues to make significant progress in developing data-derived approaches and mechanistic models that require more detailed databases. While committed to these efforts whenever possible, in the absence of data, the Agency relies on scientifically-based and health protective default approaches, consistent with Agency policies and guidelines.

Question 34: To further improve the IRIS Program, can you commit to revising the way hazard values are presented to the public to ensure that critical science policy assumptions are transparency presented and not comingled with scientific assumptions?

Answer: Yes, the EPA is committed to making sure that the scientific foundation for our decisions reflects the best possible science and that information is communicated in a transparent manner.

Question 35: What are natural environmental chemical levels? What are background, man-made chemical levels? How do you consider these levels in IRIS determinations? How do IRIS hazard values accommodate levels associated with existing natural exposures that are not known to be associated with any adverse effects at these low exposure levels?

Answer: Scientists commonly use the term "background levels" to mean three different things: (1) levels of chemical compounds that are produced within the body ("endogenous" compounds), (2) levels of substances that are in the environment from natural sources and processes (one might call these "naturally-occurring"), and (3) whatever concentrations occur from sources other than the source being considered in a decision, including sources due to human actions.

IRIS assessments are developed to provide information on the health effects associated with exposure to chemicals from sources over which the EPA has regulatory authority, including some chemicals that occur naturally in the environment at some level or are produced endogenously. IRIS values generally already take into account amounts commonly produced by our own bodies ("endogenous exposures"). The fact that a chemical is naturally produced does not make it "safe" at all doses; there are many natural products of metabolism that can have toxic effects at high enough levels. In addition, in the risk assessment paradigm, noncancer hazards and increased cancer risks are generally based on comparisons to unexposed populations. The adverse effects of hazardous agents are not driven by whether or not they are "naturally" occurring. The source of the exposure does not impact the dose at which an adverse effect is observed. Natural occurrence and background levels are more appropriately considered in the risk management strategy.

Question 36: Can you commit to ensuring that a 3rd party, independent of the IRIS Program, is tasked with ensuring that EPA staff have sufficiently considered and responded to peer reviewer and public input before assessments and other documents are finalized?

Answer: Following external peer review, the EPA revises draft assessments to respond to public and peer review comments. The revised draft is then reviewed by Agency scientists who do not work in the IRIS Program; additionally, it is reviewed by scientists from other federal agencies and the Executive Office of the President. The EPA's responses to public and peer review comments are documented in an appendix to each IRIS assessment.

Cross-Cutting Risk Assessment Concerns

Question 37: Some scientists have suggested using a weight of evidence framework that incorporates relevant and reliable data along with knowledge of hypothesized modes of action, so that there is a clear and objective presentation of the extent to which existing data and knowledge do, or do not, support each hypothesis, including the default. Do you support such an approach? If so, can you provide us with a timeline for such an approach that might be adopted within OPPT and IRIS?

Answer: Hazard identification involves integrating evidence from human, animal, and mechanistic studies to draw conclusions about a chemical's hazards. In general, IRIS assessments integrate evidence consistent with a framework developed by Sir Bradford Hill, which outlines aspects (for example, consistency, strength, biological plausibility, etc.) for considering causality in epidemiologic investigations. These were later modified and extended to experimental studies. The IRIS Program currently uses existing methodology (i.e. the 2005 Cancer Guidelines, and the 2002 Technical Report on the RfD/RfC Process) built upon the Hill criteria, to inform assessments. The IRIS Program is working toward adopting systematic review methods (for selecting and analyzing studies) and data integration or weight-of-evidence approaches (to develop overall findings). To move forward in this area, in August 2013, the EPA convened a public scientific workshop focused on approaches for evaluating individual studies, synthesizing evidence within a particular discipline, and integrating evidence across different disciplines to draw scientific conclusions and causality determinations.

The IRIS Program is committed to systematic review and weight of evidence approaches in developing assessments, including consideration of studies with positive and negative findings, and is moving forward in that area.

OPPT supports the IRIS program's approach to weight of evidence, and where available and appropriate incorporates information from IRIS into OPPT assessments. When OPPT does so, the weight-of-the-evidence considerations of the IRIS assessment are brought into the OPPT assessment in a manner consistent with the scoping of the OPPT assessment. OPPT typically assesses chemicals for which there is much less information than exists with chemicals for which IRIS assessments are conducted. As a result, the weight-of-evidence considerations for OPPT assessments that rely on relatively little data are considerably more limited, and case-specific, than those used for IRIS assessments that may have robust data sets.

Question 38: One of the biggest challenges for risk assessment is the insistence by some international regulators to use hazard as a surrogate for risk in regulatory decision-making. When EPA personnel participate in international forums where these issues are being discussed (e.g., OECD, APEC, SAICM, etc.) will you encourage them to advocate that risk be

used as the basis for human health and environmental policy development?

Answer: Yes. For example, the IRIS Program identifies the quantitative dose-response information useful for risk assessment whenever that information exists. As such, it strongly supports the ability of regulatory and other programs to base their decisions upon estimates of risk, not just hazard.
Most of the environmental statutes passed by Congress incorporate the consideration of risk into environmental decision-making within the United States. Given that, I expect that EPA personnel participating in international forums where these issues are being discussed will encourage the use of risk-based decision making.

Question 39: EPA's IRIS program completes no more than 10 assessments per year. Since 1999 the Canadian government has evaluated about 23,000 chemicals as part of its chemical management plan. By 2006, all 23,000 chemicals had been evaluated and about 4,000 chemicals were identified as requiring further review. Since then Canada has been systematically reviewing these 4,000 substances and has thus far identified a list of Priority Substances considered "toxic" under the criteria laid out in legislation for which management plans are to be created.

- Does EPA have the capacity to review the same number of chemicals in the same time period as the Canadian government?
- What did the Canadian government find that disagrees with EPA findings?
- What is EPA doing to streamline the chemical assessment process?
- Would you agree that the IRIS program can do better, and that some fundamental changes are necessary?
- What changes do you believe should be made to the IRIS program?
- Do you support broad discussions with stakeholders to re-think the IRIS framework and approach?

Answer: The efforts of the Canadian government discussed above related to chemical screening and prioritization. To our knowledge Health Canada identified a much smaller subset of the 23,000 chemicals as requiring a full assessment. We are not aware of any disagreements that EPA may have had with the initiatives or findings of the Canadian government. EPA has a number of activities focused on developing new methodologies to screen the large number of chemicals in commerce and the environment. For example, EPA has an active computational toxicology effort in its Office of Research and Development, through the Chemical Safety for Sustainability research program, that uses rapid, automated tests called "high-throughput screening assays." The computational toxicology effort is also developing high-throughput exposure predictions with the goal to generate higher throughput risk-based evaluations. To date, this effort has screened 1,800 chemicals in over 700 high-throughput assays. The EPA's endocrine disruption screening program has already started the scientific review process to use these new high-throughput screening assay data to prioritize chemicals for potential endocrine-related activity.

In September, 2013 the EPA researchers released the draft report *Next Generation Risk Assessment: Incorporation of Recent Advances in Molecular, Computational, and Systems Biology* which begins to address how the EPA can take full advantage of novel data sources in its risk assessments. In the next phase of this effort, the EPA will enter novel data streams generated by ToxCast and related research will be used to enhance and accelerate the EPA's risk-based chemical evaluations.

The EPA ORD now has a research collaboration with Health Canada to determine if the high-throughput chemical data the EPA generates through ToxCast can be used to inform decisions made about the chemicals listed in their Chemical Management Plans. This collaboration as well as others with European chemical and health agencies will help accelerate the EPA's own risk assessments in the coming years.

Regarding your questions about the IRIS Program, in July 2013, after extensive outreach and conversations with Agency partners and external stakeholders, the EPA announced changes to the IRIS Program to: 1) improve the science of assessments; 2) improve the productivity of the Program; and 3) increase transparency so issues are identified and debated early in the process. Since that time the IRIS Program is continuing to evolve, incorporating recommendations from the 2011 and 2014 NRC reports related to IRIS. As part of the changes to the IRIS Program, we are continuing our efforts in stakeholder engagement (including discussion of science and process issues) at bimonthly public science meetings where ongoing assessments are discussed. EPA anticipates that this early engagement will result in identifying issues early in the process so the pace of assessments is not slowed down by scientific controversies later on. We are also strengthening our peer review process through the use of the Science Advisory Board's Chemical Assessment Advisory Committee. We believe that, over time, these changes will increase the efficiency with which the EPA produces the in-depth reviews for which IRIS is known and respected.

Questions Regarding ORD Nominee Thomas Burke

Question 40: Thomas Burke suggested in an NAS report he chaired that information on nonchemical stressors should be incorporated into assessments and EPA should further research dollars into evaluating the interactions between chemical and nonchemical stressors.

- Do you believe that EPA has the staff, with requisite qualifications, and financial capacity to also take on evaluations of nonchemical stressors?
- Should EPA convince Congress, NAS, and all other stakeholders that they can appropriately evaluate chemical stressors before broadening their scope to include evaluation of chemical stressors?

Answer: In 2003, the EPA published the Framework for Cumulative Risk Assessment and where helpful in decision making, the EPA has assessed risks of multiple chemicals. This is an important and evolving area of science, and multiple advisory groups, such as the National

Academy of Sciences and the National Environmental Justice Advisory Committee, have urged the EPA to incorporate information about nonchemical stressors into assessments of chemicals, such as those developed through the Integrated Risk Information System (IRIS) Program. At this point, it would be difficult to routinely incorporate nonchemical stressors into chemical assessments given existing resources. However, because it is an important area of science, the EPA is funding research to increase understanding of the role of nonchemical stressors in cumulative risk assessments, including seven Science to Achieve Results (STAR) grants specifically examining the role of nonchemical stressors in cumulative risk assessment.

In addition to research on methodologies, the EPA has Technical Panels established to develop guidance on how to approach cumulative risk assessments that include chemical and non-chemical stressors. These efforts are directly related to recommendations from multiple reports from the National Academy of Sciences.

Grant Funding – Conflict of Interests

Question 41: In response to questions you stated that you have a process in place to review the eligibility of EPA grant recipients serving on peer review panels. When was this review process put into place?

Answer: The EPA has processes in place to identify potential conflicts of interest for persons (including EPA grant recipients) who may serve on peer review panels. The EPA also monitors its processes for areas of improvement. For example, in March 2013, the EPA strengthened its oversight of contractor-managed peer review panels for influential scientific and technical documents. The new oversight includes additional steps which increase transparency by allowing for a public review and comment period on potential panelists. For more information on the process, you may visit (http://www.epa.gov/osa/pdfs/epa-process-for-contractor.pdf) and http://www.epa.gov/peerreview/pdfs/peer_review_handbook_2012.pdf.

Question 42: Did EPA review in detail the grants that were obtained by current CASAC panel members and consultants to determine if there was a potential conflict?

- If so, who within EPA conducted this review?
- What does the grant review involve?
- Are the grants to the potential member's institution also reviewed?
- Can EPA share the results of this grant review with the Committee?

Answer: Yes, the SAB Ethics Officer conducted an initial review followed by a final review by the SAB Office Director, who is the Deputy Ethics Official. The grants awarded to a candidate are reviewed as part of the full review of the information provided on the confidential financial disclosure form, the EPA Form 3110-48. The SAB Staff follows the approach identified in the OMB Bulletin (p.25): "Research grants that were awarded to the scientist

based on investigator-initiated, competitive, peer reviewed proposals do not generally raise issues of independence. However, significant consulting and contractual relationships with the agency may raise issues of independence or conflict, depending upon the situation." The EPA reviews candidate's grants to ensure that they have no financial conflicts of interest, as defined by 18 U.S.C. §208 and to ensure, consistent with the EPA's Peer Review Policy, that experts will not peer review their own work. Consistent with this latter point, the scope of grants is evaluated to determine whether products developed under any grant are to be peer reviewed by a panel. Grants to a potential member's institution are not reviewed unless the grants are reported on the EPA Form 3110-48 as sources of research or project funding received by the potential member or his or her spouse in the last two years. The EPA cannot share the results of the grant review because the information reported on the confidential financial disclosure form, the EPA Form 3110-48, is deemed confidential under 5 CFR 2634.901(d). Information on recipients of the EPA grant funding are available in the public domain at http://yosemite.epa.gov/oarm/igms_egf.nsf/recipient2?OpenView. Information about the results of the EPA's ethics review is included in the Determination Memoranda posted to the CASAC website (www.epa.gov/casac) for each CASAC panel or committee established by the EPA.

- If EPA has not done the detailed review of the individual grants of CASAC panel members and consultants, why not? When will EPA conduct this review?

Answer: The grants awarded to a candidate are reviewed as part of the full review of the information provided on the confidential financial disclosure form. A review of various factors such as employment, expert testimony, grants and contracts, assets and public comments are considered and reviewed prior to each new advisory activity to determine a candidate's eligibility to participate on a panel. This process was followed for CASAC panel members and consultants.

- Under what specific circumstances would EPA conclude that a grant recipient should not serve on a peer review panel?

Answer: A candidate who has any financial or other interest that conflict with the service of the review panel would not be eligible to participate on that particular review panel. With regard to grants, the scope of grants awarded to a candidate is evaluated to determine whether products developed under any grant are to be peer reviewed by the panel.

Question 43: When EPA appointed Dr. Jonathan Samet to be chair of the CASAC panel reviewing the PM2.5 NAAQS, did EPA review EPA grants to Dr. Samet and his affiliated research institutions for a potential conflict?

Answer: Yes. Grants awarded to candidates for CASAC panels are evaluated to determine whether products developed under such grants include products that will be peer reviewed by the panel. However, as noted in guidance from the Office of Management and Budget, "when an agency awards grants through a competitive process that includes peer review, the agency's potential to influence the scientist's research is limited. As such, when a

scientist is awarded a government research grant through an investigator-initiated, peer reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects" (OMB's Final Information Quality Bulletin for Peer Review, December 16, 2004).

- How far back did the evaluation go?

Answer: The Confidential Financial Disclosure Form (EPA 3110-48) asks candidates to disclose any source of research or project funding received in the last two years preceding the date of filing.

- What was the total amount of the EPA funding provided to Dr. Samet and his research institutions in the five years leading up to his appointment?

Answer: Prior to his appointment as Chair of the CASAC PM Panel in 2008, Dr. Samet submitted the Confidential Financial Disclosure Form (EPA Form 3110-48). In accordance with instructions on the form, Dr. Samet listed sources of research or project funding received in the last two years preceding the date of filing. The EPA did not develop a total for the EPA funding provided to Dr. Samet or to his research institution in the five years preceding his appointment as Chair of the CASAC.

- If EPA grants were provided, what areas of research did the grant funding cover?

Answer: Dr. Samet reported an EPA grant focused on the physical and chemical characteristics of particulate matter (PM) that determine risk to human health, and EPA funding to support a workshop and report on the use of statistical models for low dose-response data extrapolation in environmental health risk assessments..

- Did any of the grants address PM2.5 or ozone NAAQS related science?

Answer: As noted in the previous response, Dr. Samet reported the EPA grant funding related to the health effects of exposure to fine PM. Dr. Samet was not asked to and did not review the results of any of his research funded by grants from the EPA.

Question 44: EPA's Peer Review Handbook states that experts that have made public pronouncements on an issue may lack impartiality and should be avoided; and that individuals who have "taken sides" should be avoided. According to the recently released IG Report on EPA's management of CASAC, in 2008, EPA selected Jonathan Samet as Chair of CASAC to review the PM2.5 standard even though he had published an article in 2006 opposing EPA's current PM standard. The IG Report stated that Dr. Samet failed to disclose the public statement in the disclosure form that specifically asked if he "made any public statements, written or oral, on the issue that would indicate to an observer that you have taken a position on the issue under consideration." According to the IG Report, CASAC members are also required to update this form annually and to participate in an ethics training course.

- Did the SAB staff review Dr. Samet's publications to see if a public statement had

been made?

Answer: Yes.

- Has anyone at EPA asked Dr. Samet why he omitted this important information despite a direction question on his form?

Answer: Dr. Samet provided disclosure of his public statement. In 2006, the Confidential Financial Disclosure Form (EPA Form 3110-48) did not request information on public statements. However, Dr. Samet did disclose his 2006 editorial in the *American Journal of Respiratory and Critical Care Medicine* in an e-mail to Designated Federal Officer Fred Butterfield dated 1-31-06 in direct response to a question about past public statements.

- Did Dr. Samet submit a new financial disclosure statement annually while Chair? If so, did he continually omit disclosure of his public statements on all his forms?

Answer: Yes, Dr. Samet submitted new financial disclosures on a yearly basis. His disclosures included public statements.

Question 45: Does EPA normally review publications of CASAC members and consultants to determine if public statements have been made?

Answer: Yes, this is part of our standard protocol.

Data Transparency

Question 46: In answering member questions, you stated that in response to the Shelby Amendment on data access, you have assured yourself that you have access to the underlying research data. Does this include the confidential cohort data?

Answer: The EPA has assured that the Agency has received from researchers and transmitted to Congress the research data that the Agency has determined are required to be provided under the Shelby Amendment, consistent with applicable protections for private medical and similar information. The EPA does not have access to much of the underlying data requested by Congress because that information is held solely by the outside research institutions that conducted these large-scale epidemiological studies, not the EPA.

Question 47: Given that the American Cancer Society and Harvard Six City studies were funded by the EPA, does the federal government have the ability to obtain the data that resulted from those grants under 36(c)(1)&(2) of the A-110 Circular?

Answer: The American Cancer Society studies were not funded by the EPA and, accordingly, the Agency does not possess or have access to data held solely by the outside research institution. With respect to the Harvard Six City studies, the EPA has already provided Congress the research data that the Agency has determined are subject to the Shelby Amendment.

Question 48: Can you provide us with a list of all the times EPA has obtained research data to conduct its own analysis?

Answer: The EPA conducts research and analyses on many topics in order to fulfill its mission to protect human health and the environment, and data collection for those studies and analyses occurs continually. Given the many instances of when this occurs, the EPA does not maintain a list of all the times the Agency obtains research data to conduct its own analysis. The EPA follows all applicable laws and regulations to protect private medical and similar information.

Question 49: Are there studies on PM2.5 and ozone studies that rely on publically available data sets? If so, please list those studies.

Answer: There are many studies across the scientific disciplines that use publicly available data sets that are included in the Integrated Science Assessments (ISAs) for ozone and particulate matter (ozone – http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=247492, and PM – http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=216546) The EPA maintains a comprehensive list of all studies included in these assessments in its publicly available Health & Environmental Research Online (HERO) database (http://hero.epa.gov/). Ozone (http://hero.epa.gov/index.cfm/project/page/project_id/1628); PM (http://hero.epa.gov/index.cfm/project/page/project_id/15) In many studies, however, scientific protocols require that authors not publicly report underlying data pertaining to personal medical information to protect the privacy of study participants. The EPA understands that it is important to increase transparency and public access to information, but it is also essential to protect the privacy of individuals who have served as subjects in studies along with their personal health information.

Question 50: Will EPA commit to not rely on studies for setting standards that are based on underlying data sets and methodologies that neither EPA nor the public can access and review?

Answer: The EPA is committed to transparency with regard to the scientific bases of agency decision making. The use of personal medical information does not in any way undermine the validity of the studies' results, nor does it call into question the EPA's reliance on those studies, along with thousands of other peer-reviewed studies, when the agency considers the scientific foundation for NAAQS and similar science-informed determinations, including decisions regarding methods used in risk and benefit assessments.

Questions Relating to the Use of Old Cohort Data

Question 51: The individual cohort data from the American Cancer Society and Harvard University are over 30 years old. Because the data were collected over 30 years ago, the smoking rates of the individuals in the studies have stayed the same despite a dramatic fall in smoking nationally. Similarly, the assumptions about participants' use of heart medicine and cholesterol lowering drugs have not changed over these 30 years, despite

the dramatic increases in their usage nationally.

- Does EPA believe that the outdated nature of the individual cohort data used in studies that rely on the ACS and Harvard Six City cohort data create additional uncertainties and weaknesses that could be corrected if new cohort data were used?

- Does EPA believe that the small but statistically significant decrease in deaths attributed to reduced PM2.5 exposures in these studies are, at least in part, due to reductions in smoking or increased use of medications that the studies are not addressing? If so, how can the EPA know what percent of the decrease in deaths attributed to reduced PM2.5 exposures are actually due to other factors?

Answer: The EPA considers studies based on the American Cancer Society and Harvard Six Cities cohorts as part of the full body of science on air pollution and health in establishing National Ambient Air Quality Standards (NAAQS) and in assessing the health impacts of other major rules. In the process of establishing a NAAQS, the EPA looks comprehensively at the available science, assessing thousands of scientific studies using all of the appropriate peer-review processes and guidance. For example, in the most recent PM NAAQS integrated science assessment the EPA cited approximately 2,000 peer-reviewed studies.

During the most recent review of the PM NAAQS, the EPA examined studies of newer cohorts that confirmed that premature death is associated with fine particle pollution, in some cases at pollution levels lower than those reported in studies of the American Cancer Society and Harvard Six Cities cohorts. Additionally, some of these studies based on newer cohorts showed even greater risks of premature mortality than studies of either the American Cancer Society or Harvard Six Cities cohorts.

In developing methods to use in regulatory impact analyses for major rules, the EPA evaluates a variety of long-term cohort studies, including newer cohort studies. The EPA includes an assessment of the strengths and limitations of each study to determine the most appropriate studies to use in estimating risks and health effects avoided. On balance, studies of the American Cancer Society and Harvard Six Cities cohorts follow groups of participants that are more representative of American populations in terms of age, gender, and geography than other cohorts used in currently available studies. In addition, studies conducted using these cohorts include extended follow-up analyses that capture longer-term health impacts better than other studies without long follow-up periods.

Environmental Research, Development and Demonstration Authorization Act

Question 52: The Environmental Research, Development and Demonstration Authorization Act of 1978, 42USC #4365 (ERDDAA) established the Science Advisory Board (SAB).

a. Please explain in detail how you interpret the provisions ERDDAA.

Answer: The Science Advisory Board (SAB) was established by the EPA Administrator in January 1974. Section 8 of the Environmental Research, Development and Demonstration Authorization Act of 1978 (ERDDAA), 42 USC § 4365, provided statutory authority for the SAB. The SAB is a scientific/technical federal advisory committee, subject to the requirements of the Federal Advisory Committee Act (FACA), 5 USC App. 2. The SAB reports to the EPA Administrator.

b. Explain EPA's interpretation of ERDDA's requirement that the "Administrator, at the time any proposed criteria document, standard, limitation, or regulation under the ...[CWA]... is provided to any other Federal agency for formal review and comment, shall make available to the Board such proposed criteria document, standard, limitation, or regulation, together with relevant scientific and technical information in the possession of the Environmental Protection Agency on which the proposed action is based. Id.

Answer: Under section 4365(c), EPA is required to make proposed criteria documents, standards, limitations, and regulations available to the SAB when it submits such documents to other federal agencies for "formal review and comment." "Formal review and comment" occurs when a statute requires EPA to consult with another federal agency before it can take action.

c. Explain in detail the role and powers ERDDAA gives specific Congressional Committees. Do these powers included the ability to pose charge questions to the SAB? Why or why not? Do these powers include initiating the formation of new SAB panels to provide advice to Congress? Why or why not. Please cite any relevant statutory support for these positions and explanations.

Answer: The SAB is a federal advisory committee established by the EPA Administrator and, as with all EPA federal advisory committees, is subject to "administrative guidelines and management controls" established by the EPA Administrator. (See, FACA section 8(a)). As required by FACA, the EPA DFO calls each meeting and approves the agenda for each meeting.

EPA and staff of the House Science, Space and Technology committee are developing a process for managing questions on which the specific congressional committees would like SAB advice.

d. Does the SAB have the independent power to initiate reviews? Why or why not?

Answer: As stated in ERDDAA, the SAB provides scientific and technical advice as requested by the EPA Administrator. In addition under section 4365(c), the SAB has the authority to provide advice and recommendations on "proposed criteria document[s], standard[s], limitation[s], or regulation[s]" that are "provided to any other Federal agency for formal review and comment."

e. What specifically is requires to initiate review. How were these requirements determined?

Answer: SAB reviews are initiated when an EPA program office contacts the Director of the Science Advisory Board Staff Office.

QUESTIONS FOR THE RECORD
The Honorable Paul Broun (R-GA)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

IRIS Questions

Question 1: You testified on November 14 that "the Agency's ability to pursue its mission to protect human health and the environment depends upon the integrity of the science upon which it relies. I firmly believe that environmental policies, decisions, guidance, and regulations that impact the lives of all Americans must be grounded, at a most fundamental level, in sound, high quality, transparent, science." Additionally, at the September 17, 2012, opening public meeting of the National Research Council (NRC) IRIS Review panel, EPA NCEA Director Dr. Ken Olden stated in his presentation, that "openness and transparency will be the hallmark [of IRIS assessments] going forward." At the same NRC meeting, EPA Acting IRIS Director Vince Cogliano informed the panel that "new [EPA IRIS] initiatives will increase transparency and promote involvement of the scientific community." Finally, in the NRC Formaldehyde Report (2011), the committee noted in its recommendations to EPA for improving the IRIS process overall, "in the judgment of the present and past [NRC] committees, consideration needs to be given to how each step of the [IRIS] process could be improved and gains made in transparency and efficiency." (NRC Formaldehyde Report (2011), p. 164).

In order to understand the scientific underpinnings of many EPA documents, the public has been forced to resort to using FOIA, or other approaches, to try to obtain critical information and data that the EPA has relied upon. As these tools are time consuming and create legal hurdles, the information has not been available to the public in a timely manner to inform review and public comment.

- As part of a commitment to transparency and openness, do you agree that the data and information which underlies the key scientific studies the agency relies upon in important scientific reviews, assessments, and rulemakings (e.g., NAAQS Integrated Science Assessments, IRIS Toxicological Reviews), should be available to the public?

- Can you commit to making this information available in public dockets?

Answer: Transparency and scientific integrity are very important to the agency's work. Transparency is a critical element in the EPA's Scientific Integrity Policy: "To enhance transparency with the Agency, this policy...facilitates the free flow of scientific information. The Agency will continue to expand and promote access to scientific information by making it available online in open formats in a timely manner, including access to data and non-proprietary models underlying Agency policy decisions."

The July 2013 enhancements to the EPA's IRIS program are but one example of the Agency's commitment to this policy.

Question 2: Industry and federal research efforts have invested millions to better understand how chemicals interact with biological systems at human exposure levels in order to ensure development of human health risk assessment prediction models that are as accurate and science-based as possible. However, EPA has a long track record of dismissing these types of scientific biologically-based models and asserting that such approaches cannot prove the defaults are not warranted. Demanding that science proves a negative is an anti-scientific policy and indicates a deep seated prejudice against use of mode of action knowledge to replace defaults. Why shouldn't EPA use the most up to date knowledge on mode of action and dose response at environmentally relevant exposures in lieu of outdated default approaches for hazard identification and dose response throughout the Agency, including in the IRIS Program?

Answer: In developing an IRIS assessment, the EPA looks at all of the available data, including information about mode of action. We look at the entire database of scientific information, and we systematically review that information to develop the assessment. Consistent with the Agency's *Guidelines for Carcinogen Risk Assessment*, the EPA considers a critical analysis of all relevant information as the starting point from which a default option may be invoked if needed to address uncertainty or the absence of critical information. The EPA is committed to using sound science and continues to make significant progress in developing data-derived approaches and mechanistic models that require more detailed databases. While committed to these efforts whenever possible, in the absence of data, the Agency relies on scientifically-based and health protective default approaches.

Question 3: As EPA prepared to conduct a non-cancer toxicity assessment of Libby Amphibole Asbestos, it arranged by contract for development of additional data that EPA describe as "for development of the most accurate RfC for the Libby site." These new data included advanced radiographic imaging and pulmonary function studies of the population from which the RfC would be derived. The new data were collected by the University of Cincinnati as planned, but after several years remain unpublished and undisclosed by the federal government. EPA has neither revealed its assessment of the data nor explained why it chose to prepare its draft toxicity assessment without citation to or disclosure of underlying data that was sought by EPA to ensure the accuracy of the RfC.

- Please explain how EPA reconciles not disclosing the above data with its commitment to transparency and the NRC recommendation as noted above as well as the disclosure directives of FOIA and OMB Circular No. A-130 (Revised) which express the policy that the open and efficient exchange of scientific and technical government information supports the operation of democracy and excellence in scientific research.

Answer: The collection of the pulmonary function data was included as part of the original contract with the University of Cincinnati, but was not funded by the EPA. Accordingly, the Agency does not have the pulmonary function data. With respect to the other requested information, the EPA produced a number of documents in response to a FOIA request, including:

- A spreadsheet of X-ray data from the Marysville full cohort;
- Two files of smoking data corrections made by University of Cincinnati and the EPA;
- A spreadsheet of smoking data from 1980 and 2004;
- Three manuscripts discussing the data;
- A copy of the 2005 contract award to the University of Cincinnati;
- Minutes of meetings and a schedule of deliverables related to this contract;
- A copy of the contract with SRC, Inc.;
- Statements of Work for Task Orders 0003 – Guidance Addendum for Libby Amphibole, 0005 – Libby Human Health Risk Assessment, and 0007 – Libby Operable Unit 3; and
- Monthly reports related to Task Order 0005.

The EPA withheld from production other information consistent with the FOIA and OMB Circular A-130. While the Agency is committed to transparency, the EPA has an obligation to avoid disclosing material that may be confidential business information (CBI), under the Trade Secrets Act and also under Circular A-130, which directs that agencies "[l]imit the sharing of information that ... contains proprietary information to that which is legally authorized." Two of the three documents withheld in response to FOIA request EPA-08-2013-2405 were subject to claims or class determinations of CBI status. In particular, the High Resolution Computed Tomography (HRCT) data was produced by University of Cincinnati researchers and is subject to a confidentiality claim by the University; and the contract documents contain labor rates and similar information that the EPA redacted before release in accordance with CBI Class Determination 1-95. Before releasing the HRCT data or any of the redacted portions of the contract documents, the Agency is required to determine whether any CBI claims are valid and provide notice to the affected businesses.

In addition, the Agency is committed and required to protect citizens' privacy. As noted in Circular A-130, "[t]he individual's right to privacy must be protected in Federal Government information activities involving personal information." One of the withheld documents, the exposure matrix, raised these privacy concerns. It contains medical information that could

directly and indirectly reveal asbestos exposure associated with individual workers. Because the information contains medical or similar files of individuals, including information that could allow exposure data to be traced to specific persons, the disclosure of this document would constitute a clearly unwarranted invasion of personal privacy. Therefore, the EPA withheld this document under Exemption 6.

Finally, as discussed below, we have determined that the HRCT data and the exposure matrix are covered by the deliberative process privilege of FOIA Exemption 5, in addition to the other exemptions from disclosure discussed above.

- If EPA asserts that it does not possess or have access to any portion of the data, for instance because the funding mechanism changed and someone else paid for it, please explain:

    a. In the interests of transparency and sound science, why EPA did not affirmatively obtain for its own use the data during RfC development, especially since EPA had described the data as needed "for development of the most accurate RfC."

Answer: While the EPA included the collection of the pulmonary function and the advanced radiographic imaging data (HRCT data) in the contract with University of Cincinnati, the task for this data collection was not funded by the EPA. Further, the EPA did not affirmatively obtain any portion of this non-EPA-funded data, because the data had not yet been published in a peer-reviewed journal. The Agency uses only peer-reviewed, published data in IRIS toxicity assessments.

    b. Which governmental agencies provided funding for the development of the data

Answer: The Agency for Toxic Substances and Disease Registry provided the funds for these investigations by the University of Cincinnati.

- We understand that EPA received a Freedom of Information Act Request (FOIA) for the above data, and subsequently withheld a portion of the data based upon: the deliberative process privilege. EPA explained by letter of November 1, 2013 that it was withholding the data because:

    The withheld documents, and portions of documents, are protected by the deliberative process privilege because ***they reflect the internal discussions, advice, analysis, and recommendations that were considered in developing the [IRIS] Assessment for Libby Amphibole Asbestos.*** *The records were created prior to the finalization of this IRIS Assessment. Furthermore, withheld records were not circulated outside the Agency.* ***Release of the withheld material would prematurely disclose proposed policies before they are finally adopted*** *and cause public*

confusion by disclosing reasons and rationales that were not in fact ultimately the grounds for EPA's final assessment.

We further understand that the deliberative process privilege does not ordinarily cover scientific information and data, and "government researchers must be willing to expose the underlying data to public scrutiny." Chicago Tribune Co. v. United States Dept of Health and Human Servs., 1997 U.S. Dist. 2308 at *52 (N.D. Ill. Feb. 26, 1997). In light of this, please explain how the deliberative process privilege protects against disclosure of data, and whether the data should be produced to the public under FOIA.

Answer: In response to FOIA request EPA-08-2013-2405, the EPA withheld two documents based in part on deliberative process grounds: an Excel spreadsheet of advanced radiographic imaging data (HRCT data) and an exposure matrix with individual worker exposure calculations. In neither case was deliberative process the only basis for withholding. The Excel spreadsheet of HRCT data was claimed as confidential business information by the University of Cincinnati, while the exposure matrix contained medical information associated with individual workers. Accordingly, the EPA also withheld these documents under Exemptions 4 and 6 as applicable.

The EPA determined that the two withheld documents were also subject to the deliberative process privilege because the records were internal and not disclosed outside the federal government or its contractors; predecisional because the records were created before the finalization of the *IRIS Assessment for Libby Amphibole Asbestos*; and deliberative because the records were intertwined with decisions related to the IRIS assessment. Further, it would tend to reveal the "nascent thoughts" of Agency scientists and would thus "discourage the intellectual risk-taking so essential to technical progress." *Chemical Mfrs. Assoc. v. Consumer Product Safety Com.*, 600 F. Supp. 114, 118 (D.D.C. 1984). Accordingly, the release of this withheld information would prematurely disclose proposed policies before they were finally adopted and could cause public confusion by disclosing reasons and rationales that were not ultimately the grounds for the *IRIS Toxicological Review of Libby Amphibole Asbestos*, which has not yet been finalized.

The EPA does not find the unpublished *Chicago Tribune* opinion quoted above determinative. In that case, the district court made its statement about data not as a general rule of law but as a logical conclusion in light of the specific circumstances, which are different from the facts here. As you are aware, in the *Chicago Tribune* case, the District Court reviewed the appropriateness of asserting Exemption 5's deliberative process privilege on raw data in patient data forms. In contrast, the withheld records contain more than mere facts and raw data. The information included deliberative discussions and preliminary results

For these reasons, the Agency determined the information was exempt from disclosure under Exemption 5's deliberative process privilege.

Question 4: EPA is identifying the non-cancer adverse effect for the draft toxicological assessment of Libby Amphibole Asbestos as pleural plaques, asserting there is an association with certain functional impairment of the lung. It has come to our attention that the question of whether pleural plaques cause any clinically significant impairment is highly disputed and controversial. In light of this information:

- Is EPA considering discarding the assertion that pleural plaques cause lung decrements or any other functionally significant impairment because this initially proposed basis for selecting pleural plaques as the adverse effect lacks the needed scientific support?

a. If so, in the interest of transparency, please explain EPA's current position as to which adverse effect it is using for its non-cancer toxicological assessment, the basis for selecting that adverse effect, and whether the Agency will provide the opportunity for public comment on any change in its position.

Answer: The EPA's draft IRIS assessment of Libby Amphibole Asbestos includes an inhalation reference concentration (RfC) that is based on the presence of localized pleural thickening, an abnormality of the lining of the lung. "Localized pleural thickening" is a more recent term that encompasses what historically was known as "pleural plaques." This draft EPA assessment was reviewed by the Agency's Science Advisory Board (SAB) in 2013, and the question of basing the RfC on "localized pleural thickening" was discussed during this peer review. The SAB, in their peer review report, stated that "localized pleural thickening is an appropriate health endpoint for the derivation of the inhalation reference concentration." They went on to say that it is an "irreversible structural, pathological alteration of the pleura and is generally associated with reduced lung function." The final SAB peer review report is available at: http://yosemite.epa.gov/sab/sabproduct.nsf/0/4F2A245C7160456B85257B030072E5D3/$File/EPA-SAB-13-001-unsigned.pdf

The EPA is currently revising the assessment to address the peer review and public comments. Following this, the revised draft will be reviewed by Agency scientists and the EPA will lead a science discussion with other federal agencies and the Executive Office of the President. After this, the EPA will move forward to complete the assessment.

Question 5: Do you agree that all studies should be independently judged based on their quality, strength, and relevance regardless of the author affiliation or funding source?

Answer: Author affiliation or funding source does not impact how studies are judged within the IRIS Program. In addition to quality, strength, and relevance, it is important that studies used in IRIS assessments are peer reviewed.

Question 6: Do you agree that chemicals associated with the human body's natural

processes should be addressed specifically and separately in the development of an EPA hazard value or risk assessment?

Answer: IRIS assessments are developed to provide information on the health effects associated with exposure to chemicals from sources over which the EPA has regulatory authority, including some chemicals that occur naturally at some level. There are many natural products of metabolism that can have toxic effects at high enough levels; the fact that a chemical is naturally produced does not make it "safe" at all doses. For noncarcinogens, IRIS typically estimates a concentration that if inhaled, or a dose that if ingested, is expected to be without appreciable risk of deleterious effects during a lifetime. The risk evaluated is typically the risk of increased effect – beyond the effects observed in the "unexposed" group or population. For carcinogens, the EPA typically estimates what additional risk might be caused by additional exposure compared with an "unexposed" population. As such, IRIS values generally already take into account amounts commonly produced by our own bodies ("endogenous exposures") in how they are derived.

Question 7: An analysis presented at the Society of Toxicology meeting showed that 67% of the Hazardous Air Pollutants (HAPs) have no IRIS value.

a. Do you believe that HAPs should be priorities for assessment within the IRIS Program?
b. What are the criteria for selecting chemicals for assessment within the IRIS Program?
c. Can you commit to developing a clearly articulated prioritization process for high priority IRIS assessments that benefits from, and is responsive to, engagement from all stakeholders?

Answer: The EPA recognizes that HAPs are important, and the IRIS Program works with the EPA's program and regional offices, including the Office of Air and Radiation, to develop the IRIS agenda. In the past few years, the IRIS Program has completed assessments for several HAPs, including tetrachloroethylene, trichloroethylene, methanol, and 1,4-dioxane. Additionally, the IRIS Program currently is working on developing assessments for several HAPs; examples include formaldehyde, naphthalene, and stryene.

The EPA periodically solicits nomination of chemicals to be assessed through the IRIS Program. Anyone can nominate chemicals for assessment, including the EPA Program Offices and Regions, other Federal agencies and the Executive Office of the President, as well as any stakeholders and the public. The EPA routinely publishes a Federal Register Notice announcing the opportunity to nominate chemicals for the IRIS agenda, and we also post information on the IRIS website. We use six general criteria for selecting chemicals for the IRIS agenda:

1. Potential public health impact;
2. EPA statutory, regulatory, or program-specific implementation needs;

3. Availability of new scientific information or methodology that might significantly change the current IRIS information;
4. Interest to other governmental agencies or the public;
5. Availability of other scientific assessment documents that could serve as a basis for developing an IRIS assessment; and
6. Other factors, such as widespread exposure.

The EPA has committed to the Government Accountability Office that it will better describe for internal and external stakeholders and the public the nomination and selection process for determining chemicals to be assessed by the IRIS Program, including the rationale for not selecting nominated chemicals.

Utility MACT and Other Air Quality Issues

Question 8: There are many groups that analyze the impacts of the EPA regulations. In particular, most of these groups analyze job losses. These include, for example, job losses due to higher energy prices. How does the EPA determine job losses that are caused by a proposed rule or a final rule? For example, do you use a model to determine job losses? When you analyze the job impacts of a rule that affects power plants-- for example, the Utility MACT rule that will cost $10 billion per year-does the EPA analyze job losses in industries that have to pay higher energy prices?

Answer: The EPA is keenly aware that these are tough economic times and there is particular concern about impacts on employment. That is why we have expanded our discussions of possible employment impacts in our rules. It is important to note that the EPA uses different approaches for employment analysis for different rules (drawing on peer-reviewed research), always takes public comment on those analyses, and has worked with academic researchers to improve our understanding of available tools.

Question 9: In a 2012 letter, you stated that "the best scientific evidence... is that there is no threshold level of fine particle pollution below which health risk reductions are not achieved by reduced exposure." Do you believe that any of the criteria air pollutants under the Clean Air Act (ozone, lead, sulfur dioxide, nitrogen oxides, carbon monoxide, coarse particulate matter) have a threshold below which they are not harmful to human health (or may be beneficial)?

Answer: The EPA's evaluation of scientific evidence in the most recent Integrated Science Assessments for each of the criteria air pollutants did not identify a level of exposure below which these pollutants pose no risk of harm. In the pollutant-specific ISAs, the EPA considered available scientific information from short and/or long-term exposure studies to examine the shape of the concentration – response functions and whether or not a threshold exists. While the EPA recognizes that there likely are biological thresholds for specific health responses for individuals, the PM ISA concluded that the overall evidence from existing epidemiological studies does not support the existence of thresholds for

populations.

Question 10: Last month, the World Health Organization classified outdoor air pollution as carcinogenic to humans. Do you think ambient air in America causes cancer?

Answer: The EPA has not conducted an evaluation of the potential of the collective mixture of outdoor air pollution to cause cancer in humans. However, in its 2009 Integrated Science Assessment for Particulate Matter, the EPA found that "overall, the evidence is suggestive of a causal relationship between relevant PM 2.5 exposures and cancer, with the strongest evidence from the epidemiologic studies of lung cancer mortality."

Question 11: According to the Office of Management and Budget, benefits from reducing particulate matter represent a majority of all benefits for all regulations across the entire federal government. Do you agree?

Answer: Based on recent reports from the Office of Management and Budget (OMB) on the benefits and costs of federal regulations, the EPA regulations have the highest monetized benefits across federal agencies, and a large percentage of these monetized benefits are from air pollution controls that reduce exposure to fine particles. The link between exposure to fine particle and adverse health effects is well-established in the scientific literature, including premature death, cardiovascular effects, and hospital admissions and emergency department visits for heart attacks, strokes, and asthma attacks. As OMB notes, it is not always possible to quantify or to monetize benefits in light of limits in existing information, and these non-monetized benefits can be important.

Question 12: Your predecessor, Lisa Jackson, previously testified that "If we could reduce particulate matter to healthy levels, it would have the same impact as finding a cure for cancer." Cancer kills roughly 600,000 people in this country each year. Do you agree with Administrator Jackson's statement?

Answer: Recent scientific publications are consistent with the findings of EPA's Second Prospective Study, The Benefits and Costs of the Clean Air Act, 1990 to 2020, that particulate matter is associated with thousands of premature deaths each year. Fann et al (2011) found that exposure to recent levels of $PM_{2.5}$ is associated with 120,000 to 320,000 premature deaths each year. A study in the New England Journal of Medicine (Pope et al. 2009) found that reduced levels of fine particles between 1990 and 2000 increased life expectancy at birth by about ½ a year; and, Correia et al. (2013) found that reduced particle levels between 2000 and 2007 further increased life expectancy.

In addition, the peer-reviewed burden of disease study concluded that ambient particulate matter pollution remains one of the top 10 health risk factors in the U.S. The study published in the Journal of the American Medical Association included co-authors from many health agencies. A copy of the study: http://jama.jamanetwork.com/article.aspx?articleid=1710486.

Question 13: Will your Agency propose a new National Ambient Air Quality Standard for ozone before the end of 2014?

Answer: The EPA has not yet reached a decision about what revisions to the ozone standards may be appropriate in light of the current scientific evidence. The EPA intends to issue a proposed decision addressing the question of whether it is appropriate to revise the current primary and secondary ozone NAAQS by December 1, 2014 (as required by court order), and the public will have a chance to review and comment on the proposal before the EPA issues a final rule.

EPA's Second Peer Review on the Bristol Bay Assessment

Question 14: In the development of the Agency's Bristol Bay Assessment, the Agency without soliciting any public input, asked the original twelve peer reviewers to give their opinions on how well the Agency responded to the comments that these peer reviewers made on the first draft of the Bristol Bay Assessment. Will you release the peer reviewers' comments now, before the final Bristol Bay Assessment is released? This will not in any way prejudice the Assessment, and will be in keeping with your commitment to both transparency and sound science.

Answer: On January 15, 2014, the EPA released the final Bristol Bay Watershed Assessment, which is available on EPA's website
at: http://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=253500.
Concurrent with release of the final assessment, the EPA posted the agency's response to the peer review comments
at: http://www.epa.gov/ncea/pdfs/bristolbay/EPAs%20Response%20to%20Peer%20Rev%20Comments.pdf. This response includes responses to the 2012 peer review comments as well as the 2013 peer review follow-up evaluations.

The EPA followed a transparent and open public process in developing the Bristol Bay Watershed Assessment, and the Assessment was subjected to rigorous and independent expert peer review. Twelve independent scientists with expertise in mine engineering, salmon fisheries biology, aquatic ecology, aquatic toxicology, hydrology, wildlife ecology, and Alaska Native cultures reviewed the assessment for its scientific quality. The same peer reviewers evaluated the revised draft to determine how well the EPA addressed their comments.

The peer review report from the 2012 peer review is available
at: http://www.epa.gov/ncea/pdfs/bristolbay/Final-Peer-Review-Report-Bristol-Bay.pdf

The peer review report from the follow-up peer review in 2013 is available
at: http://www.epa.gov/ncea/pdfs/bristolbay/PR_Follow-on_Comments.pdf

Climate Regulations

Question 15: When EPA released its regulations on new power plants in September, they were criticized because they would have a negligible impact on climate change. However, you have repeatedly emphasized that if we get enough countries on board we can make a difference, and you have said that a key goal of EPA's rules is to help leverage some kind of international agreement.

With that in mind, will you assure us that EPA will not take unilateral action on climate-which EPA itself acknowledges is not sufficient to make a measurable impact-but rather only proceed with rules if other major emitting countries like China agree to similar binding regulations? If not, why not?

Answer: The President's Climate Action Plan notes that it is imperative for the United States to couple action at home with leadership internationally. As part of this overall strategy, the EPA is contributing to a demonstration of U.S leadership through regulatory and non-regulatory programs that reduce emissions, take advantage of domestic sources of energy, and create jobs. Simultaneously, the Department of State is leading the effort to forge an effective global approach that includes greenhouse gas mitigation contributions from other major emitting countries, such as China.

Question 16: In 2009, President Obama committed to the U.S. to reducing greenhouse gas emissions 17 percent below 2005 levels by 2020. If EPA's power plant regulations are implemented, will the U.S. achieve that goal?

In accordance with the U N Climate Change Conference in Warsaw that concluded on November 23 with an agreement for additional cuts beyond 2020, the U.S. is expected to support additional reductions beyond the President's 2020 goal. What will EPA have to regulate in order to meet those commitments? In other words, does EPA intend to regulate natural gas-fired powered plants in order to meet these new commitments?

Answer: In January 2014, the US government completed its first Biennial Report, which included the latest estimates of historical emissions, and projected future greenhouse gas emissions out to 2020. The Biennial Report concluded that new measures, consistent with the President's Climate Action Plan, will put the United States on a path to reach the U.S. goal of achieving reductions in the range of 17 percent below 2005 levels by 2020. Included in the Climate Action Plan is EPA's Clean Power Plan. This proposed rule, if finalized, would contribute importantly to the achievement of our existing 2020 goal and to offering a robust post-2020 contribution in the context of the new climate agreement that will be concluded in Paris in 2015.

QUESTIONS FOR THE RECORD
The Honorable Larry Bucshon (R-IN)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

Definition of Fill Material

Question 1: The current definition of fill material, finalized in May, 2002, unified the Corps and EPA's prior conflicting definitions to solidify decades of regulatory practice. However, both EPA and the Corps have stated that they are now considering revising the definition of fill material. Ken Kopocis at his nomination hearing pointed to the 2009 Supreme Court decision in Coeur Alaska v. Southeast Alaska Conservation Council as justification, stating that there is "remaining ambiguity regarding circumstances where discharges of fill material (e.g., mine tailings) may also be covered by an Effluent Limitation Guideline." Do you believe that such ambiguity exists, and will EPA be seeking to address that issue?

Answer: The EPA agrees that some confusion remains after the 2002 Fill Rule and subsequent memo discussing implementation issues in the context of Alaska hardrock mining. The Corps and the EPA have at various times discussed actions for both the waste treatment system exclusion and the definition of "fill material" that could provide additional clarity. However, the EPA has no active discussions with the Corps at this time on revising the agencies' definition of "fill material."

Water Quality Criteria- Conductivity

Question 2: While EPA's conductivity "benchmark" that it had applied to Appalachian streams were set aside by the U.S. District Court for the District of Columbia in the case of NMA v. Jackson, EPA recently published several papers supporting its conductivity actions, and announced that it is developing a water quality criteria.

a. Will EPA's new criteria be a regional criteria, or applicable nationwide?

Answer: The EPA is currently working to develop a draft recommended field-based method for states to develop ambient aquatic life water quality criteria for conductivity. The method, if finalized, would provide a method that states and authorized tribes,located in any region of the country, may use to develop field-based conductivity criteria for adoption into water quality standards. It would not impose any binding water quality criteria on any state, but instead would provide recommendations to states as they develop such criteria. The field-based method will allow states to develop science-based conductivity criteria that appropriately reflect ecoregional- or state-specific factors such as background conductivity and ionic and aquatic community composition.

b. As is required by law, will EPA be applying its conductivity criteria to all CWA permits, regardless of industry?

Answer: As described above, the EPA is currently working to develop a draft recommended field-based method for states to develop ambient aquatic life water quality criteria for conductivity. If and when such a criterion is finalized, the EPA would work closely with states to ensure that its scientific recommendations, if adopted, are implemented consistent with the Clean Water Act.

c. In the past, EPA has not addressed scientific critiques that have produced evidence that conductivity is not a good indicator of benthic/aquatic health. Going forward, what plans does EPA have to take this growing number of studies into account?

Answer: Best-available peer-reviewed scientific literature, including literature developed by EPA scientists, identifies a strong causal connection between elevated conductivity levels and harmful effects on downstream aquatic life[1]. The EPA continues to rely on the latest peer-reviewed scientific information to develop its draft recommended national field-based method for conductivity. The EPA anticipates that its draft method will undergo independent external peer review and will be made available to the public to provide scientific views, which the EPA will take into account before finalizing the method.

Selenium Water Quality Criteria

Question 3: EPA is currently involved in a scientific assessment of Selenium that will be used to propose a new national Selenium water quality criterion. Yet, EPA constantly pushes back a potential release date for its proposal, which is causing uncertainty for operations nationwide.

a. What is EPA's proposed release for a selenium water quality criteria?

Answer: In May 2014, the EPA released a draft updated national recommended aquatic life criterion for selenium and requested scientific views on the draft document. The agency received scientific views until July 28, 2014 and is currently reviewing the scientific information it received. As of August 2014, the draft document is undergoing an independent, contractor-led, external expert peer review. After considering public and

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[1] Pond, G.J., M.E. Passmore, F.A. Borsuk, L. Reynolds, and C.J. Rose. 2008. *Downstream Effects of Mountaintop Coal Mining: Comparing Biological Conditions Using Family- and Genus-Level Macroinvertebrate Bioassessment Tools.* J. N. Am. Benthol. Soc. 27(3):717-737.
U.S. Environmental Protection Agency. *A Field-Based Aquatic Life Benchmark for Central Appalachian Streams (Final Report).* 2011. EPA-600-R-10-023F, Appendix C.
U.S. Environmental Protection Agency. *The Effects of Mountaintop Mines and Valley Fills on Aquatic Ecosystems of the Central Appalachian Coalfields* (Final Report). 2011. EPA-600-R-09-138A.

expert peer review feedback, the EPA will revise and publish the draft criterion document and subsequently again request public comment. Once finalized, the EPA's water quality criterion for selenium will provide recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act. The EPA anticipates issuing final water quality criteria for selenium in 2015.

b. What is EPA's strategy for incorporating relevant scientific critiques and comments EPA receives into its final Selenium criteria?

Answer: As described above, the EPA has requested scientific views on its external peer review draft document, and also will be soliciting independent scientific peer-review comments on the document. The EPA will consider both public and peer review comments in revising the document prior to issuing a proposed criterion. The EPA will then again solicit and consider public comments on the proposed criterion, and revise the proposed criteria appropriately, prior to issuing final criteria. The EPA will also develop and publish summaries of how it addressed public and peer review comments it received on the draft criterion.

c. How is EPA taking the site-specific nature of Selenium issues into account when developing the national standard?

Answer: The EPA's draft selenium criterion takes into account a large national data set of measured selenium concentrations in aquatic systems, while also providing guidance on developing site-specific criteria. The draft criterion reflects a large database containing paired environmental measurements of selenium in water, fish, plankton, invertebrate species, and detritus from numerous sites as the basis for the national criterion, based on a peer reviewed, well-accepted model of selenium bioaccumulation developed by U.S. Geological Survey scientists (Presser and Luoma, 2010).[2] The model applied in the EPA's draft also enables development of site-specific selenium criteria through a scientific, rigorous analysis process provided in the text and appendices of the draft document. At the EPA's request, the USGS has provided technical comments on EPA's implementation of the model in this instance, including comments related to procedure, process, and inputs.

Court Cases- *National Mining Association v. Jackson*

Question 4: The U.S. District Court for the District of Columbia in the case of NMA v. Jackson recently struck down several EPA actions- specifically, EPA's Enhanced Coordination Process (ECP) and Multi-Criteria Integrated Resource Assessment (MCIR) for Appalachia surface coal mining, as well as EPA's guidance document, "Improving EPA Review of Appalachian Surface Coal Mining Operations Under the Clean Water Act, National Environmental Policy Act, and the Environmental Justice Executive Order" - as violating the CWA and Administrative

[2] Presser and Luoma, 2010. A Methodology for Ecosystem-Scale Modeling of Selenium. Integrated Environmental Assessment and Management. 6: 685-710.

Procedure Act, as well as, in the case of the guidance document, the Surface Mining Control and Reclamation Act. In your confirmation hearing, you stated that the Agency has directed its field offices not to use the guidance documents affected by the court decision. However, very few mining permits have been issued since the decision.

How does that outcome comport with the District Court's decision, and what additional steps do you think are needed to adhere to the District Court's decision?

Answer: On July 11, 2014, the U.S. Court of Appeals for the District of Columbia Circuit reversed the D.C. District Court's decision that set aside the EPA-Corps Enhanced Coordination Procedures and the EPA's July 21, 2011 final guidance on Appalachian surface coal mining operations.

The EPA is not the permitting authority in Appalachia for either Section 402 or Section 404 of the Clean Water Act. However, the EPA does provide comments on draft Section 402 permits developed by Appalachian States, and on Section 404 public notices issued by the U.S. Army Corps of Engineers. The EPA continues to review draft Clean Water Act permits and public notices and is eager to resolve any issues that arise in order to facilitate timely permitting, consistent with best-available science and the law.

Court Cases -*Mingo Logan Coal Co. v. EPA*

Question 5: In March, 2012, the U.S. District Court for the District of Columbia struck down EPA's retroactive revocation of a mining-related CWA Sec. 404 permit, holding unequivocally that EPA has no authority to retroactively veto CWA Sec. 404 permits issued by the U.S. Army Corps of Engineers. However, EPA appealed that decision and in April of 2013, the U.S. Court of Appeals for the District of Columbia reversed the decision of the District Court.

a. What do you think the practical effect on industry would be of having Sec. 404 permits be subject to EPA's veto even years after permit issuance and even if the permittee is in full compliance with the terms of the permit?

Answer: The EPA takes very seriously the authority provided to the Agency by Congress, pursuant to Section 404(c) of the Clean Water Act (CWA), to determine whether discharges of dredged or fill material into a specified site in waters of the U.S. would result in an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas. Indicative of the EPA's thoughtfulness in using this authority is the fact that the Agency has completed 13 Final Determinations since 1972 pursuant to CWA Section 404(c) -- only three of which were in connection with projects for which Section 404 permits had issued already. To put this in perspective, over the same period of time, the Corps of Engineers is estimated to have authorized more than two million activities in waters of the U.S. under the CWA Section 404 regulatory program. As these numbers demonstrate, the EPA has worked successfully with the Corps and permit applicants to

resolve concerns without exercising its Section 404(c) authority in all but a miniscule fraction of cases.

As you are aware, this matter remains in litigation, so the EPA is unable to discuss this matter in greater detail.

b. During deliberations on the Clean Water Act in Congress, Senator Muskie noted that there are three essential elements to the Clean Water Act-- "uniformity, finality, and enforceability". How do the assertions made by EPA regarding the scope of its authority under Sec. 404 comport with the notion of permit finality? How have you, pursuant to your testimony at your confirmation hearing, worked to implement the CWA to provide uniformity, finality and enforceability?

Answer: Please see response to question 5(a) above.

Bristol Bay Draft Watershed Assessment

Question 6: In response to petitions from environmental organizations to initiate a 404(c) veto process for a potential mine site in Bristol Bay before a permit application was submitted, EPA - pointing to its authority under CWA Sec. 104 - initiated a draft watershed assessment that involved the crafting of a hypothetical mining scenario in Bristol Bay.

a. EPA has stated that the assessment will not have any legal consequences, but also that it is intended to provide a scientific and technical foundation for decision-making. How exactly does EPA intend to utilize this study under your leadership?

Answer: The EPA conducted the Bristol Bay Watershed Assessment to better understand the Bristol Bay watershed and its resources. As a scientific report, the final assessment did not recommend policy or regulatory decisions. The EPA believes the final assessment can serve as a valuable resource for the public and for federal, state, and tribal governments as they consider how best to address the challenges of mining and ecological protection in the watershed.

Separate from the Bristol Bay Assessment but based in part on the results of that assessment, on February 28, the EPA announced that the agency was initiating a process under the Clean Water Act to identify appropriate options to protect the world's largest sockeye salmon fishery in Bristol Bay, Alaska, from the potentially destructive impacts of the proposed Pebble Mine. The EPA based its action on available information, including data collected as part of the agency's Bristol Bay Watershed Assessment as well as mine plans submitted to the U.S. Securities and Exchange Commission. On July 18, EPA Region 10 issued a Proposed Determination pursuant to Section 404(c) of the Clean Water Act and is currently seeking public comments on its proposal. The EPA held seven public hearings from August 12-15 at which the public could provide oral or written comments to the agency. EPA Region 10 will also meet with tribes for formal consultation. Following the close of the public

comment period, EPA Region 10 will review public comments on its proposal and consider next steps in the process, which could include moving toward a Recommended Determination to the EPA Assistant Administrator for Water.

b. EPA has full authority under the well-established Sec. 404 process to review any future permit application submitted to make a determination as to whether or not there will be any of the unacceptable adverse effects listed in CW A Sec. 404(c) at the disposal sites being considered by the U.S. Army Corps of Engineers, including unacceptable impacts to fishery areas and wildlife. Why, then, is EPA using its limited resources to conduct a watershed assessment on a hypothetical mining scenario that even EPA's scientific review panel found did not accurately reflect the conditions of a real mine, rather than allow the companies that have invested millions of dollars to submit their proposal which EPA would then review?

Answer: As described above, the EPA developed the Bristol Bay Watershed Assessment in response to petitions from nine federally recognized tribes and other stakeholders who asked us to take action to protect Bristol Bay's salmon populations. They expressed concern that the Bristol Bay salmon fishery would be at risk from the potential Pebble Mine. We also heard from other tribes and stakeholders who support development in the Bristol Bay watershed and have requested that the EPA take no action and allow a typical permitting process to proceed. In light of the agency's important Tribal Trust and consultation responsibilities and the significant fishery resources of Bristol Bay, the agency decided to conduct a scientific assessment to understand how large-scale mining could potentially affect water quality and salmon ecosystems in the watershed. As described above, the EPA believes that its final assessment is valuable to the public and for federal, state, and tribal governments as they consider how best to address the challenges of mining and ecological protection in the watershed.

c. What impact do you think EPA's actions with respect to Bristol Bay will have on investment in U.S. property and natural resource development?

Answer: As noted above, EPA Region 10 recently issued a Proposed Determination pursuant to Section 404(c) of the Clean Water Act and is currently seeking public comments on its proposal. Through this process, the agency will work to identify appropriate options to protect the world's largest sockeye salmon fishery in Bristol Bay, Alaska, from the potentially destructive impacts of the proposed Pebble Mine. The agency made clear that its action reflects the unique nature of the Bristol Bay watershed as one of the world's last prolific wild salmon resources and the threat posed by the Pebble deposit, a mine unprecedented in scope and scale. The agency also made clear that its action does not reflect any EPA policy change with respect to mine permitting.

d. Has EPA considered the positive environmental justice impacts high-paying jobs and tax revenue will have on the region?

Answer: As part of the EPA's development of the Bristol Bay Watershed Assessment, the agency reviewed existing information on salmon fishery economics, which provided important contextual information about the importance of the salmon fishery. This information is provided in Volume 2, Appendix E of the final Bristol Bay Watershed Assessment.[3] However, the agency's watershed assessment did not represent a cost-benefit analysis of mining or fishing, nor did it present an evaluation of the economic viability or economic impacts of any proposed large-scale mining project.

QUESTIONS FOR THE RECORD
The Honorable Steve Stockman (R-TX)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

Interagency Taskforce on Development of Unconventional Natural Gas Resource

Background Statement on Task Force:

- On April 13, 2013, the President signed an executive order (EO) forming an interagency Task Force to support the safe and responsible development of unconventional natural gas resources.
- In the Policy section of that EO the president states that "it is vital that we take full advantage of our natural gas resources" while doing it safety.
- The EO outlines the function of the Task Force as coordinate agency policy activities, sharing scientific and economic information, long-term research and infrastructure planning and consultation among agencies.
- EPA is a member of that task force at the Deputy level according to the EO.

Question 1: Mrs. McCarthy, who is EPA's representative to this Task Force and how often does it meet?

Answer: The EPA's interim representative to the Task Force is Acting Deputy Administrator Lisa Feldt. An outgrowth of the Task Force meetings was greater support for interagency efforts to coordinate high priority research associated with safely and prudently developing unconventional oil and gas (UOG) resources through the Federal Multiagency Collaboration on Unconventional Oil and Gas Research. The EPA, the Department of the Interior and the Department of Energy have each contributed policy and technical officials to the Collaboration's Steering Committee. Through this team and the creation of a Technical Subcommittee, comprised of DOI, DOE, EPA, and Department of Human Health Services scientists and engineers, the agencies help foster research collaboration and coordination. The collaboration's Steering Committee has been meeting on a weekly basis.

[3] The final assessment and its appendices are available at http://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=253500.

Question 2. Have you personally been briefed on the Task Force activities?

Answer: I am regularly briefed on the EPA's research activities, including our collaboration and coordination with fellow federal agencies.

Question 3: Can you provide an update to this Committee today on EPA's activities and focus areas as a member of this Task Force?

Answer: The DOE, DOI and EPA continue to coordinate and collaborate on research devoted to UOG production to conduct timely scientific and technology research. A significant part of this effort involves the overall sharing of information among the agencies. The three agencies have also engaged other Federal partners and stakeholders through a variety of mechanisms. Together the agencies have finalized a strategy document that identifies current and future research needs, and highlights projects that are both underway and could be undertaken to address these needs, available at (http://unconventional.energy.gov).

Question 4: There are a number of Executive Branch departments and agencies engaged in some fashion in unconventional resource development. Can you provide your opinion on the level of coordination on policy activities, sharing of information and, in particular, and your thoughts on long-term research in the area of infrastructure planning?

Answer: As mentioned above, EPA, DOE, and DOI are coordinating their research efforts devoted to high priority research associated with safely and prudently developing UOG resources. A major part of this effort involves the sharing of information among the agencies.

Question 5: Last week, Interior Secretary Jewell said that there is a lot of misinformation about fracking and that quote "Fracking has been done safely for many, many years."

a. Do you agree with Secretary Jewell that fracking has been done safely for many years?

Answer: Responsible development of America's unconventional oil and natural gas resources offers important economic, energy security, and environmental benefits. The EPA is committed to working with states and other stakeholders to understand and address potential concerns with unconventional oil and gas development so the public has confidence that it will proceed in a safe and responsible manner. In so doing, we will continue to follow a transparent, science driven approach with significant stakeholder involvement. The EPA continues to move forward on our national research study on the potential impacts of hydraulic fracturing for oil and gas on drinking-water resources in response to a request from Congress. The agency is working in consultation with a variety of stakeholders and has provided many opportunities for the exchange of information and input on the study design and the research as it progresses.

b. What parts of the fracking process do you feel are being done safely?

Answer: Responsible development of America's unconventional oil and natural gas resources offers important economic, energy security, and environmental benefits. As stated earlier, the EPA is committed to studying and addressing potential concerns related to unconventional oil and gas development so that the public has confidence that it will proceed in a safe and responsible manner. In so doing, we will continue to follow a transparent, science-driven approach with significant stakeholder involvement.

c. Are there any parts of the fracking process that you feel are not safe?

Answer: See (b) above.

Credibility and Ability of EPA Science

Background Statement on EPA Science

- In 2009 legislation, Congress directed EPA to conduct a study on hydraulic fracturing and groundwater.
- Rather than following the statute –how HF affects groundwater-EPA has outlined a sprawling study plan that goes well beyond groundwater issues.
- EPA initially did not recognize this as a "highly influential" study subject to OMB's Peer Review Bulletin, has not been able to garner an industry partner in conducting perhaps the most important aspect of its study plan – the "before and after" prospective study, and also had an EPA science debacle when its scientists independently pursues research in Pavillion, WY.
- Today, at the end of 2013, EPA still has not issues the study and we are told not to expect it until 2016.

Question 1: Can you please describe for us what happened with the study of effects of hydraulic fracturing on Water? Why it got so far off course, and what EPA is doing to get this effort back on track? What do you think this says about the state of EPA's science process and its ability to be timely and relevant?

Answer: EPA is conducting an assessment of the potential impacts of oil and gas hydraulic fracturing activities on drinking water resources in the United States. The study scope was designed to meet Congress' request and was established in November 2011 in the Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, after public comment and peer review by the Science Advisory Board. The scope has not changed since the release of the final study plan. The assessment will represent the state of the science on this topic as supported by an extensive review of the literature, results from recently completed EPA research projects, and input from states, industry, non-government organizations, the public, and other stakeholders. We remain committed to providing a high quality scientific document.

a. Can you please explain the decision to conduct a sprawling study rather than investigate the narrow question Congress posed?

Answer: The scope of the *EPA's Study of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources*, which was supported by the Science Advisory Board, was designed to be responsive to the request from Congress. There has been no expansion of the scope beyond the original appropriations language.

b. Can you please explain the initial decision not to designate this as a "highly influential" document subject to OMB's Peer Review process?

Answer: The EPA designated the report a Highly Influential Scientific Assessment. There was no initial decision to not designate the report as such.

c. I am concerned that EPA has not been able to get any industry partners for the before-and-after prospective case study. Can you please explain the apparent impasse between EPA and industry stakeholders on the issue? Can you please describe the issues around protocols around the study that we hear is one source of friction between EPA and industry?

Answer: We have worked closely with industry partners to try to identify suitable locations for prospective case studies that meet the scientific needs of the study and industry's business needs. We continue to explore opportunities and, so far we have not identified a suitable location. For a location to be suitable, it is necessary to gather a minimum of one year of characterization data for ground water and surface water prior to and following unconventional exploration activities in the study area, and for there to be no other hydraulic fracturing activities on adjacent properties, during the entire study period, which could last several years.

d. I would note that the University of Texas, EDF and 9 companies partnered for a landmark study to look at emissions from oil and gas operations. That study took about a year. This tells me that industry partnerships are possible and that your agency should be able to find common ground with industry to conduct the study.

EPA's Role in Assuring the Public that Fracking is Safe

Background Statement on EPA's Role in Public Confidence:

- In that same interview last week, Secretary Jewell called on industry to educate the public on safety of hydrofracking
- I agree, and it would seem to me that industry is trying to do just that:
  - Industry is participating with NGO's and academics to confirm the low emission rates of methane
  - Industry is implementing more stringent standards for drill sites, well bores and air emissions

- Industry is working with states to implement more stringent regulatory requirements to further assure the safety of their operations
- Industry has stepped up to the plate to try and educate the public on the safety of their operations

- However, EPA has not been so helpful:
  - You publish ground water contamination studies that are then discredited and withdrawn
  - You don't rebut flawed air emission studies that report methane emissions an order of magnitude higher than EPA's estimates
  - Last week in testimony before the Senate EPW, your Director of Atmospheric Programs (Ms. Sarah Durham) couldn't even make a positive statement about the UT/EDF air emissions study that basically confirmed EPA's estimate of emission from unconventional gas development operations

Question 1: Mrs. McCarthy, what role do you see EPA playing in assuring the public that unconventional oil and gas development, development that President Obama supports, is safe?

Answer: Responsible development of America's unconventional oil and natural gas resources offers important economic, energy security and environmental benefits. The EPA is working with stakeholders to help ensure that oil and gas development is done in a safe and responsible manner. In particular, the EPA is working in partnership with states, which have key regulatory authority relevant to unconventional oil and natural gas extraction. The goal of EPA's drinking water assessment report is to help eliminate any potential impacts to drinking water from unconventional oil and gas development.

Question 2: Do you agree that EPA mis-steps around groundwater contamination can lead to a loss of public confidence?

Answer: In its groundwater investigations, the EPA took action when the agency became aware of information indicating potential threats to human health. The EPA's actions generally focused on obtaining additional data and information in an effort to better understand and assess potential threats to public health and the environment. The agency consulted with its state and tribal partners prior to taking such measures and shared data and information with homeowners, the relevant state agencies and, where applicable, tribal authorities. In each case, the EPA relied upon sound science as it sought to provide clarity to these stakeholders and ensure that public health was protected, while working closely with individual states. The EPA will continue to work with state partners and other stakeholders to help ensure that oil and gas extraction is done in a safe and responsible manner.

Question 3: Do you agree that failure to acknowledge reports confirming your own emission estimates and failure to discredit obviously flawed reports can lead to a loss of public confidence?

Answer: The EPA continues to use the best available data to produce its estimates of GHG emissions in the U.S. Greenhouse Gas Emissions and Sinks Inventory (Inventory). In recent years, the natural gas sector has experienced significant growth and changes in industry practices, and only recently have newer data and studies become available to improve our understanding of emissions for these sources. In the Inventory, the EPA discusses relevant information and data available on emissions from the oil and gas sector from reports that confirm, as well as conflict with the EPA estimates.

Recently, the EPA received new information and data related to the oil and gas sector emission estimates through the annual Inventory preparation process, the formal public notice and comment process of the proposed oil and gas New Source Performance Standards for volatile organic compounds, and through a stakeholder workshop on the natural gas sector emissions estimates. All relevant information provided was carefully evaluated, and updates were made to two key sources: liquids unloading, and completions with hydraulic fracturing and workover with hydraulic fracturing (re-fracturing). The EPA updated its estimates for liquids unloading using new industry data sets, and used data reported to the Greenhouse Gas Reporting Program (GHGRP) to develop a revised method for hydraulically fractured well completions and workovers. As expected, incorporating newly available data has resulted in changes to emissions estimates for the oil and gas sector overall. Updating estimates with newly available data is part of the EPA's standard process for improving the Inventory, and we look forward to receiving feedback on the EPA's approach and use of the data through the Inventory review process.

Question 4: Can you see how EPA's silence on the wide range of hydrofracking issues being debated can lead to a loss of public confidence?

Answer: The EPA is helping build public confidence through several initiatives, first and foremost being the Agency's national research study on the potential impacts of hydraulic fracturing for oil and gas on drinking-water resources. The agency is working in consultation with a variety of stakeholders and has provided many opportunities for the exchange of information and input on the study design and the research as it progresses. Ultimately, the results of this study are expected to inform the public and provide policymakers at all levels with high-quality scientific knowledge.

The EPA is also working to provide regulatory clarity with respect to existing laws and use existing authorities where appropriate to enhance public health and environmental safeguards. For example, in February, the EPA released an interpretive memorandum to clarify requirements under the Safe Drinking Water Act's Underground Injection Control program, for underground injection of diesel fuels in hydraulic fracturing for oil and gas extraction. The agency also released technical guidance containing recommendations for EPA permit writers to consider in implementing these UIC Class II requirements.

In addition, on May 9, 2014, the EPA issued an Advance Notice of Proposed Rulemaking

under Toxic Substances Control Act sections 8(a) and 8(d) seeking public comment on what information should be reported and disclosed for hydraulic fracturing chemicals and mixtures and the approaches for obtaining this information, including non-regulatory approaches. EPA is also soliciting input on incentives and recognition programs that could support the development and use of safer chemicals in hydraulic fracturing. This public process will help inform EPA's efforts to promote the transparency and safety of unconventional oil and gas activities. The public can provide comments through September 18, 2014. The EPA also anticipates moving forward on revisions to existing technology-based wastewater regulations to provide additional controls on discharges to wastewater treatment plans associated with the unconventional oil and gas extraction industry.

In addition, in 2012 the EPA finalized the first federal air regulations for natural-gas wells that are hydraulically fractured, along with requirements for several other air emission sources in the oil-and-gas industry that were not regulated at the federal level. A key component of the final rules is expected to yield a nearly 95 percent reduction in volatile organic compounds emitted from more than 11,000 new hydraulically fractured gas wells each year. To help reduce burdens on operators and regulators while achieving environmental benefits, the 2012 rule provides for an alternative to submission of voluminous hard copy well completion records as part of annual compliance reports. Specifically, this "NextGen Compliance" alternatives allows operators to document compliance with the green completion requirements by submitting well identification information and digital photographs (bearing the time, date, and geographic coordinates) of green completion equipment in operation at the well during flowback following hydraulic fracturing.

Question 5: Secretary Jewell, less than 6 months into the job, is trying to instill some confidence with the public on hydrofracking – isn't it time EPA do so as well?

Answer: As detailed in #4, above, the EPA is moving forward on a wide variety of initiatives related to hydraulic fracturing. The agency is seeking to identify innovative approaches that could result in greater environmental benefits and transparency while remaining mindful of the importance of this sector to our country. We are continuing to look at further opportunities for the EPA to support implementation by states and industry of hydraulic fracturing best practices.

Clean Air Science Advisory Committee Transparency and Accountability Issues

Background

- On September 11, the EPA Inspector General released a final report titled *"EPA Can Better Document Resolution of Ethics and Partiality Concerns in Managing Clean Air Federal Advisory Committees"*.

- The report raised a number of alarming issues regarding the operation of EPA's Clean

Air Science Advisory Committee (CASAC) and leaves many unanswered questions.

- CASAC is the advisory committee that during the past five years has recommended dramatic reductions in standards for nitrous oxides, sulfur oxides, particulate matter and ozone.

- The current ozone standard is under review again by CASAC and they are expected to make yet another recommendation to dramatically lower the ozone standard.

CASAC Financial Conflicts of Interest and Independence

Background on Financial Conflicts of Interest and Independence:

- CASAC members and contract advisors, or research institutions they are affiliated with, receive substantial grants from EPA for air quality research.
- In one case, Dr. Jonathan Samet, or his affiliated research institutions received almost $30 million dollars in EPA grants for research; Dr. Samet was the chair of the PM CASAC and currently serves on the ozone CASAC.
- In fact, several serving CASAC members have received over $1 million dollars from EPA for research.
- The IG Report confirms that a CASAC member's research grant is a potential area of concern if the Committee plans to address work performed under the research grant.
- Despite the millions in grant funding to CASAC members, it is unclear from the Report whether anyone actually investigated to see if those grants compromised their independence.
- The IG also found 9 instances where steps taken to mitigate independence or partiality matters were either not adequately documented or needed additional steps to sufficiently address potential independence or partiality concerns.
    - This included two instances where CASAC members contributed to studies or sections of CASAC reports under review by the CASAC panel creating a situation where they were opining on their own work.

Question 1: Mrs. McCarthy, it's hard to know where to start. EPA is selecting advisors that are receiving millions of dollars from EPA for research. According to the IG Report, some of the selected advisors were also found to be reviewing or opining on elements of their own work; and that the Agency is not following existing agency procedures regarding conflicts of interest, or taking steps to mitigate issues when they are identified. What steps is EPA taking in light of the IG Report to assure that the current CASAC ozone panel is impartial?

Answer: The Inspector General (IG) concluded that the EPA Science Advisory Board Staff Office "has adequate procedures for identifying independence and impartiality concerns," (EPA Office of Inspector General, Report No. 13-P-0387, Sept. 11, 2013) but called for better documentation when members with independence concerns or the appearance of a lack of

impartiality as defined in 5 C.F.R. 2635 are allowed to serve.

For the current ozone panel, the EPA has evaluated and will continue to evaluate experts on the basis of their confidential financial disclosures, responses to the four supplemental ethics questions on the Confidential Financial Disclosure Form (EPA Form 3110-48) and other information gathered by the EPA staff. The EPA Form 3110-48 requests detailed information about candidates' employment, consulting and volunteer work, compensated expert testimony; sources of research or projecting funding, assets and information to determine any loss of impartiality. The form requests experts to respond to four supplemental ethics questions with respect to the review document under consideration:

1. Do you know of any reason that you might be unable to provide impartial advice on the matter to come before the panel/committee/subcommittee or any reason that your impartiality in the matter might be questioned?
2. Have you had any previous involvement with the review document(s) under consideration including authorship, collaboration with the authors, or previous peer review functions? If so, please identify and describe that involvement.
3. Have you served on previous advisory panels, committees or subcommittees that have addressed the topic under consideration? If so, please identify those activities.
4. Have you made any public statements (written or oral) on the issue that would indicate to an observer that you have taken a position on the issue under consideration? If so, please identify those statements.

In its ethics review, the EPA strives to ensure that panel members are fair-minded scientific and technical experts, free from conflicts of interest and the appearance of a loss of impartiality as defined in 5 C.F.R. 2635, and possessing the ability to engage in constructive discussions among scientists with disparate perspectives. The EPA follows required legal procedures and documents any special circumstances when members with conflicts of interest or the appearance of a loss of impartiality as defined in 5 C.F.R. 2635 are allowed to serve on a panel. The EPA also documents its resolution of any question that may be posed related to independence or lack of objectivity of an expert allowed to serve on a panel.

Question 2: Please explain to me why the CASAC recommendation last year to lower the PM standard, a recommendation the EPA took, was not biased or not independent given these serious findings by the IG?

Answer: We could find nothing in the IG report (EPA Office of Inspector General, Report No. 13-P-0387, September 11, 2013) that would call into question the impartiality of the recommendations of the CASAC Particulate Matter Review Panel.

Question 3: Will you commit here today not to select CASAC members and consultants that receive EPA funding for NAAQS related air quality research? There are certainly plenty of qualified individuals out there not on EPA's payroll.

Answer: Consistent with OMB guidance and other federal agency practice, the EPA does not consider the current or past receipt of EPA grants generally to be an appearance of a loss of impartiality, but instead considers information about the EPA grants as they relate to the specific advisory activity. The EPA will continue to follow guidance issued from the Office of Management and Budget that states that "When an agency awards grants through a competitive process that includes peer review, the agency's potential to influence the scientist's research is limited. As such, when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review." (Joshua Bolten, Director, Office of Management and Budget, Issuance of OMB's Final Information Quality Bulletin for Peer Review, 12-16-04.)

CASAC Lack of Impartiality

Background:

- Federal ethics regulations require CASAC members to avoid appearances of a lock of impartiality.
- EPA's Peer Review Handbook states that experts that have made public pronouncements on an issue may lack impartiality and should be avoided; and that individuals who have "taken sides" should be avoided.
- In 2008, EPA selected Jonathan Samet as Chair of CASAC even though he had published an article in 2006 opposing EPA's current PM standard.
- As Chair of CASAC, Dr. Samet presided over the review of the PM standard and made recommendations to lower the PM standard.
- Dr. Samet failed to disclose the public statement in the disclosure form that specifically asked if he "made any public statements, written or oral, on the issue that would indicate to an observer that you have taken a position on the issue under consideration. "
- CASAC members are also required to update this form annually and to participate in an ethics training course.

Question 1: Has anyone at EPA asked Dr. Samet why he omitted this important information despite a direction question on his form?

Answer: Dr. Samet provided information about his public statements. In 2006, the Confidential Financial Disclosure Form (EPA Form 3110-48) did not request information on public statements. However, Dr. Samet did disclose his 2006 editorial in the *American Journal of Respiratory and Critical Care Medicine* in an e-mail to Designated Federal Officer Fred Butterfield dated 1-31-06 in direct response to a question about past public statements.

Question 2: Did Dr. Samet submit a new financial disclosure statement annually while Chair? If so, did he continually omit disclosure of his public statements on all his forms?

Answer: Yes, Dr. Samet submitted annual disclosures. He did not omit disclosure of his public statements.

Question 3: Did Dr. Samet participate in all the required ethics training courses?

Answer: Yes

Question 4: Why did the SAB staff not check his publication list to see if a public statement had been made?

Answer: Dr. Samet did disclose his 2006 editorial in the *Am J Respir Crit Care Medicine (Vol 173, pp. 365-369)* in an e-mail dated 1-31-06 to Designated Federal Officer Fred Butterfield.

Question 5: Why aren't the financial disclosure forms (in whole or part) made public to allow the public to assist in reporting financial or potential impartiality conflicts?

Answer: Financial disclosures are deemed confidential under 5 CFR 2634.901(d).

Question 6: If EPA had known, would the SAB staff have avoided Dr. Samet's appointment as Chair of CASAC?

Answer: No. In fact, the EPA was informed of Dr. Samet's 2006 editorial cited above. The EPA considers the full picture of an individual's professional activities, including public statements, as well as the individual's reputation in the field. Given a scientist with a long track record of highly-regarded research and publications, it is reasonable to expect that he would reach conclusions based on his professional activities. Based on the totality of Dr. Samet's scientific credentials and published work, we did not and do not believe his statement is evidence that he is not objective and open-minded. Moreover, the National Academies[4] and other groups have stated that experts who have made public statements should not be excluded experts as long as they can be fair-minded in participating in advisory activities.

Question 7: Should EPA have a clearer policy of not appointing a person to a scientific advisory committee like CASAC if conclusive information has been provided showing a public statement has been made that suggests a clear bias (or removing them, if the evidence emerges after they have been appointed)?

Answer: The EPA's policy is stated above in response to questions 1 and 6.

Question 8: Given that the Chair of CASAC was clearly biased in his opinion prior to serving as Chair of the PM CASAC panel, did his participation undermine the ability of CASAC to provide independent advice during the 2012 PM review? Does that compromise the scientific validity of the resulting NAAQS?

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[4] The National Academies, "Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports," May 2003: Available at http://www.nationalacademies.org/coi/bi-coi_form-0.pdf (Accessed 10/21/13).

Answer: No. The CASAC PM Panel developed scientifically credible and objective advice on the matters brought before it by the EPA.

The Honorable Dan Lipinski (D-IL)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

Question 1: According to the EPA Inspector General, EPA violated Section 1605 of the American Recovery and Reinvestment Act, which plainly requires all public works projects funded by ARRA to use iron, steel, and manufactured goods that are produced in the United States. The IG found that submersible pumps and centrifugal blowers for wastewater treatment plants in Illinois were purchased from foreign companies that control no manufacturing facilities in the U.S. In addition, EPA has claimed that payments to American lawyers and marketing firms made these goods Buy American compliant. This incorrect interpretation of the law was perhaps the most disconcerting part of this incident because it could lead to future similar violations of Buy American laws. Can you tell me what steps the EPA has taken since this incident, and will take in the future, to prevent similar incidents? How will EPA ensure it doesn't spend taxpayer dollars on foreign goods when that money could be spent on American made items?

Answer: The EPA Office of the Inspector General (OIG) issued OIG Report 11-R-0700, "American Recovery and Reinvestment Act Site Visit of Wastewater Treatment Plant-Phase II Improvement Project, City of Ottawa, Ill.," on September 23, 2011. Two specific issues were raised by the report: first, that the wastewater treatment plant in Ottawa, IL, did not comply with the Buy American requirement of the American Recovery and Reinvestment Act (ARRA); and second, that the guidance provided by the Office of Water (OW) for compliance with the Buy American requirement was faulty and should be revised in accordance with OIG recommendations.

After initial discussions between OW and the OIG led to continuing disagreement about the legal requirements of the Buy American requirement, as well as the test described in the OW guidance, the matter was referred to the EPA's Chief Financial Officer for arbitration and resolution. No resolution was reached. The OIG, following resolution procedures, requested final resolution by the Acting Administrator of EPA. Both parties met with the Acting Administrator on April 1, 2013.

The OW guidance required a three-question test to determine whether substantial transformation of a manufactured good took place in the U.S. In order to prove that substantial transformation took place, only one of the three questions needed to be answered affirmatively. The first question addressed situations in which all components of a good were manufactured in the U.S. and assembled into the final product in the U.S. The second question addressed situations in which important processing work was done in the

U.S. prior to assembly. The third question, which addressed situations in which the most significant of the potentially transformative work in the U.S. is assembly of components into the manufactured good, was the only one at issue in this dispute. Under no circumstances would the hiring of American lawyers or marketing firms be a factor in determining whether a manufactured good was substantially transformed in the U.S. The OIG agreed that the use of a substantial transformation test was appropriate, but felt that the third question was not stringent enough.

On May 10, 2013, the Acting Administrator issued his final decision on the matter and concluded that the test as set out by OW was appropriate for use in determining whether manufactured goods were substantially transformed in the US and did not require revision. The decision memo resolved the OIG recommendation concerning the guidance and the alleged noncompliance on the Ottawa project.

In circumstances where a finding of noncompliance with the Buy American requirement was not disputed, the violating community was either required to remove the item in question and replace it with an American-made good, or if removal was impossible or impractical, the community was required to reimburse the State SRF program the cost of the non-U.S. item.

Question 2: A constituent company in my district, Seeler Industries, has had questions about enforcement of regulations made under the General Duty provision of the Clean Air Act. As you know, under the General Duty provision, companies have a general duty to maintain a safe facility preventing and minimizing the effects of releases of extremely hazardous substances. I completely support the principle behind this provision, but in practice this company has found that regional EPA inspectors have a wide authority to enforce the provisions they see fit. In addition, according to the company, the rules under the general duty provision may run counter rules promulgated by DHS for chemical safety. What are you doing to make clear to chemical companies what the requirements are for compliance with the general duty provisions? What are you doing to clarify jurisdictional issues between EPA and DHS on chemical safety?

Answer: The EPA has taken numerous steps to assist sources with complying with the General Duty Clause. For example, the EPA published detailed guidance (*Guidance for Implementation of the General Duty Clause Clean Air Act Section 112(r)(1)*, May 2000) and a fact sheet on the Clean Air Act General Duty Clause (GDC). The guidance is primarily intended to assist the EPA inspectors in promoting compliance with the GDC. However, it is a public document that establishes the agency's expectations for compliance, and is therefore also useful to owners and operators of covered facilities in understanding their obligations under the GDC. The fact sheet provides owners and operators of stationary sources with information on GDC compliance and also refers readers to the guidance for more detailed information. The GDC guidance documents, fact sheets and numerous chemical safety alerts that promote awareness of chemical hazards and provide information on safety measures that facilities can take to control or mitigate hazards can be obtained from the EPA's website: www.epa.gov/emergencies/guidance.htm#rmp.

The EPA has the authority to issue regulations and implement programs intended to prevent accidental chemical releases, and to minimize the consequences of such releases under CAA section 112(r)(7). In addition, many federal agencies have important roles and have specific statutory responsibilities in chemical safety and security that may impact chemical plant security. The EPA is focused on the prevention of and the preparation for chemical accidents arising from natural disasters or technological failure while the Department of Homeland Security (DHS) is focused on addressing acts of terrorism or other security-related concerns. Other agencies, such as the Occupational Safety and Health Administration in the Department of Labor, also have a role in preventing chemical disasters impacting workers. Each agency, in the course of fulfilling its mandates, coordinates its actions when it impacts roles of other agencies so that the policies implemented are complementary as allowed under current law.

The Honorable Mark Takano (D-CA)
U.S. House Committee on Science, Space and Technology
Strengthening Transparency and Accountability within the Environmental Protection Agency

Question 1: Thank you for your testimony before the House Committee on Science, Space and Technology on November 14, 2013. I appreciated learning more about your work at the Environmental Protection Agency, particularly your efforts to protect public health through enforcement of the Clean Air and Clean Water Acts.

On the Subject of clean water, I have additional questions pertaining to the proposed regulations that seek to clarity the bodies of water that should be subject to Clean Water Act jurisdiction. The EPA recently issues a draft scientific report on the connectivity of water, which remains under review by the Science Advisory Board. This report will serve as the scientific foundation for the proposed regulation.

As a member who represents a Southern California district, it is important that the members of the SAB who are putting together this report have an understanding of the water issues in the arid West. As you know, the water challenges and issues we face are vastly different from the Eastern and Midwestern parts of the U.S.

- What steps did the Agency take to ensure that the makeup of the SAB is "regionally" balances and more specifically, includes members who have a working understanding and knowledge of Western water issues?

Answer:

For the SAB Staff Office, a balanced committee or panel is characterized by inclusion of candidates who possess the necessary domains of knowledge, the relevant scientific

perspectives, and the collective breadth of experience to adequately address the Panel's charge. In forming the SAB Panel for the Review of the EPA Water Body Connectivity Report, the SAB Staff Office recognized the importance of selecting individuals who had knowledge of the connectivity of aquatic systems in different regions of the U.S. Therefore, a regionally balanced panel was selected. The Panel includes members who have knowledge of the connectivity of western aquatic systems and, in particular, arid west systems. Of the 27 individuals on the Panel, 3 are from the Northeast, 6 are from the South, 6 are from Midwest, and 12 are from the West. The expertise of the 12 members from western states is outlined below.

Dr. Allison Aldous, the Nature Conservancy

Dr. Aldous is a freshwater scientist with The Nature Conservancy in Portland, Oregon. She leads a major partnership between The Nature Conservancy and the U.S. Forest Service with the goal of improving the protection of groundwater-dependent resources on national forests across the U.S.

Dr. Lee Benda, Earth Systems Institute

Dr. Benda is a research geomorphologist at Earth Systems Institute in Mt. Shasta, California. He has been involved with the creation of NetMap, a community based system of tools and digital landscapes that provides consistent analytic stream layers and digital landscapes, coupled to analysis tools, across the western United States.

Dr. Kurt Fausch, Colorado State University

Dr. Fausch is a Professor in the Department of Fish, Wildlife, and Conservation Biology at Colorado State University in Fort Collins, Colorado. His research has focused on the importance of connectivity among critical habitats for fish in river hydroecosystems, and includes studies conducted throughout Colorado and the West, and worldwide.

Dr. Michael Gooseff, Colorado State University

Dr. Gooseff is an Associate Professor in the Department of Civil and Environmental Engineering at Colorado State University in Fort Collins, Colorado. He conducts research on stream-groundwater interactions.

Dr. Charles Hawkins, Utah State University

Dr. Hawkins is the Director of the Western Center for Monitoring and Assessment of Freshwater Ecosystems at Utah State University in Logan, Utah. He conducts research on the physical, chemical, and biotic condition of aquatic and riparian ecosystems.

Dr. Michael Josselyn, Wetlands Research Associates

Dr. Josselyn is a Principal with WRA, Inc. (Wetlands Research Associates) in San Rafael, California. He teaches an annual Wetland Delineator Certification course with a focus on arid west systems. He has completed wetland delineations in arid west systems including desert

dry washes, wet meadows in the Sierra Nevada Mountains, vernal pools in the Central Valley, and inland and coastal marshes.

Dr. Kenneth Kolm, Hydrologic Systems Analysis

Dr. Kolm is President/Senior Hydrogeologist and Hydrologic and Environmental Systems Specialist at Hydrologic Systems Analysis in Golden, Colorado. Dr. Kolm specializes in the fields of hydrogeology, geomorphology, and hydrologic and environmental systems analysis.

Dr. Mark Murphy, Hassayampta Associates

Dr. Murphy is a principal scientist at Hassayampta Associates in Tucson, Arizona. Dr. Murphy's research has focused on the connectivity in arid fluvial systems. He was a Principal Investigator for the Arid West Water Quality Research Project.

Dr. Duncan Patten, Montana State University

Dr. Patten is Director of the Montana Water Center and Research Professor with the Department of Land Resources and Environmental Sciences at Montana State University in Bozeman, Montana. He is also Professor Emeritus in the School of Life Sciences and past director of the Center for Environmental Studies at Arizona State University. His research interests include arid and mountain ecosystems, especially the understanding of ecological processes of riparian, wetland, and riverine ecosystems.

Dr. Jack Stanford, University of Montana

Dr. Stanford is the Director of the Flathead Lake Biological Station in Polson, Montana and is the Jessie M. Bierman Professor of Ecology at the University of Montana. He has conducted long-term studies in the Flathead River-Lake Ecosystem in Montana and British Columbia.

Dr. Maurice Valett, University of Montana

Dr.Valett is Professor of Systems Ecology at the University of Montana in Missoula, Montana. His research focuses on ecosystem ecology and biogeochemistry, nutrient retention in lotic ecosystems, groundwater-surface water exchange, floodplain river interactions, and wetlands and streams as flow-through systems.

Dr. Ellen Wohl, Colorado State University

Dr. Wohl is Professor of Geology in the Department of Geosciences at Colorado State University in Fort Collins, Colorado. Her research focuses on physical process and form in rivers, particularly headwater rivers, as these interact with ecological and human communities. She currently serves on the Grand Canyon Science Advisory Board.

Question 2: Recently, a document surfaces that appears to be the proposed water connectivity regulations that OMB is currently reviewing. If this is the proposed rule that was put forth by EPA and the US Army Corps of Engineers, it would appear that all tributaries will

be considered waters of the U.S. subject to regulations under the Clean Water Act. I have heard concerns that the language of the proposed rule could be broadly interpreted to encompass water conveyance and delivery systems.

- I have heard concerns that under the proposed rule it would be possible that the California Aqueduct and other features of California's vast water delivery system would be considered tributaries to be regulated under the Clean Water. Is that your understanding, how will it affect water delivery for tens of millions of Californians?

Thank you for your attention to my questions. I look forward to your response and continuing to work with you to protect our environment.

Answer: On March 25, the EPA and the U.S. Army Corps of Engineers released a proposed rule in order to provide additional clarity regarding the geographic scope of Clean Water Act jurisdiction and to improve national consistency and predictability. The comment period on the agencies' proposed rule will be open until October 20, 2014.

The agencies do not believe the proposed rule would change the jurisdictional status of water conveyance and delivery systems. However, the agencies look forward to further discussing the proposed rule with states and other stakeholders, including Western water utilities, to ensure that the agencies' rulemaking efforts provide greater clarity, preserve existing exemptions, and improve protections for our nation's waters. The agencies welcome comment on this issue, and the agencies will carefully consider such comments before publishing a final rule.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

2321 RAYBURN HOUSE OFFICE BUILDING

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November 13, 2014

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

Dear Administrator McCarthy,

Questions posed to the Environmental Protection Agency (EPA) are asked in the interest of the American people. However, your agency's response to my official Questions for the Record (QFRs) from a Science, Space, and Technology Committee hearing nearly a year ago were evasive and long over-due. Unfortunately, this kind of obstructionism has come to be the norm, not the exception.

In order to properly fulfill our oversight responsibilities, the Science Committee needs honest and timely responses. I recognize that we may have to temper expectations when QFRs are lengthy. However, it becomes a waste of taxpayer resources when nine months or more pass between when a question is asked and when the answer is communicated.

In your September 2014, response to the Committee's December 2013, questions you wrote that "the appropriate protocol is to make such a request through a separate letter to the agency." It is hard to understand how it took you nearly a year to formulate this simple response. Furthermore, the need for an additional and separate request letter is perplexing. One can only conclude that this charade was a deliberate attempt to stall Congressional oversight.

Again, the Committee requested records pertaining to the role the Scientific Advisory Board (SAB) played in providing advice regarding the EPA's carbon dioxide standards for fossil fuel fired power plants under Clean Air Act section 111. The EPA should immediately provide:

- All communications between EPA employees and any SAB members or SAB Work Group members related to section 111 proposals or any information relied upon in the section 111 proposals.
- Records of all peer review of any scientific or technical information the section 111 proposals rely on.
- All records of any SAB or the SAB Work Group review or input into the proposed standards and input into EPA's development of regulations of section 111 regulations.

In addition to responding to this request, please publish this information in the official docket for the section 111 proposals. *Verify in writing that what you send is a complete record, not a partial record.*

Given the urgent nature of this request, please contact my staff to facilitate an expedited delivery of this material. Thank you for your prompt response to this matter.

Sincerely,

Lamar Smith
Chairman
Committee on Science, Space and Technology

cc: The Hon. Eddie Bernice Johnson, Ranking Member, Committee on Science, Space, and Technology

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States

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December 17, 2013

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Dear Administrator McCarthy:

On behalf of the Committee on Science, Space, and Technology, I want to express my appreciation for your participation in the hearing entitled "Strengthening Transparency and Accountability within the Environmental Protection Agency" on Thursday, November 14, 2013.

You have received a verbatim electronic transcript of the hearing for your review. The Committee's rule pertaining to the printing of transcripts is as follows:

> *The transcripts of those hearings conducted by the Committee and Subcommittees shall be published as a substantially verbatim account of remarks actually made during the proceedings, subject only to technical, grammatical, and typographical corrections authorized by the person making the remarks involved.*

Transcript edits, if any, should be submitted no later than January 2, 2014. If no edits are received by the above date, we will presume that you have no suggested edits to the transcript.

I am also enclosing questions submitted for the record by Members of the Committee. These are questions that the Members were unable to pursue during the time allotted at the hearing, but felt were important to address as part of the official record. **All of the enclosed questions must be responded to no later than January 2, 2014.**

All transcript edits and responses to the enclosed questions should be submitted to us and directed to the attention of Taylor Jordan at Taylor.Jordan@mail.house.gov. If you have any further questions or concerns, please contact Mr. Jordan at 202.225.5967.

Thank you again for your testimony.

Sincerely,

Lamar Smith
Chairman

Enclosure: Member Questions and Transcript

QUESTIONS FOR THE RECORD
The Honorable Lamar Smith (R-TX)
U.S. House Committee on Science, Space, and Technology

Strengthening Transparency and Accountability within the Environmental Protection Agency

Thursday November 14, 2013

Hydraulic Fracturing Study Questions

1. EPA's Hydraulic Fracturing Study is concerning because EPA is searching for what is *possible* without paying attention to what is *probable*. For example, the primary goals of the study are to answer questions such as "What are the *possible impacts* of hydraulic fracturing fluid surface spills on or near well pads on drinking water resources?"

   It appears EPA's independent science advisors share this concern. For example, one Science3 Advisory Board (SAB) expert commented that "There is no quantitative risk assessment included in EPA's research effort. Thus, the reader has no sense of how risky any operation may be in ultimately impacting drinking water. This is also a significant limitation of the work."

   Is the mere *possibility* of an event occurring sufficient to justify regulatory action?

2. The Director of EPA's Office of Science Policy, Dr. Hauchman, stated in May of 2012 that the Agency is implementing "a pretty comprehensive look at all the statutes to determine where "holes" may allow for additional federal oversight."

   Is this study part of that comprehensive look? What statutes were looked at as part of this effort? What regulatory "holes" has EPA identified?

3. Given that there have been no proven instances of groundwater contamination, and that greenhouse gas emissions have actually declined thanks to natural gas, what problems are you seeking to solve?

4. What has the Agency done to prevent repeating mistakes made in Parker County, Pavillion, and Dimock regarding fracking? Please include specific policy and protocol changes and actions taken.

5. Has EPA has rescinded the draft Pavilion report and if the draft report has been removed from the hydraulic fracturing drinking water study and scientific advisory board scope?

6. In addition to the retrospective and prospective case studies, it is our understanding that there are 18 additional research projects that EPA had undertaken to help answer the secondary research questions of the study.

   - How is the EPA conveying the information from these projects to the public?

- Will details be posted on the study website?
- What is the plan for peer review of the completed projects?
- What is the role of the SAB Hydraulic Fracturing Research Advisory Panel with respect to these projects and their final reports?
- What is the role of the SAB Hydraulic Fracturing ad hoc panel?
- What is the ad hoc panel's review schedule for the remainder of the study?

7. Is EPA planning to release the raw data from the five Retrospective case study sites to the public via the study website? If so, when will that be available and will the needed context be included when released?

8. Have states been forthcoming with data under the current Request for Information on the September 2012 study? If not, how have you reached out to these states, particularly those states where a retrospective case study is located?

9. Has the EPA done any testing in real time for sites that are currently being developed? If not, does the agency plan to do testing in real time at any sites?

10. What has been your work with DOE and USGS to date on the study?

11. How are you accounting for fracturing technology innovations as part of the study?

12. Do you believe hydraulic fracturing can be performed in a safe and responsible manner?

13. Could you tell us what plans the EPA has for addressing methane – particularly in regards to midstream and upstream systems?

Ozone Questions

14. If EPA sets a lower NAAQS of 60 to 70 parts per billion for ozone, do you believe there will be parts of the country that cannot meet the new standard due to background concentrations of ozone? If so, what would be the economic and regulatory consequences for a state that cannot meet the new standard?

15. Is it fair for the EPA to include Mexican and Canadian emissions in its background estimates when the states will be forced to control for international ozone emissions?

General Air Pollution/NAAQS

16. Considering the limits of science and technology, what is EPA's strategy for working within the framework established by Congress to effectuate the NAAQS?

17. Because of many factors, such as regulatory uncertainty, the funding for and construction of new long-term, base load power is dwindling. How do you balance new regulations that may benefit human health and the environment via decreased emissions against increased energy costs and the possibility of increased blackouts – both of which have a negative impact on human health?

18. What is your vision to address international transport and what is your plan for equipping states to address these issues?

19. Do you believe EPA has legal authority to require changes from other nations in order to address international transport?

20. What is EPA's plan to address the imbalance created via the adoption of standards and requirements without the tools necessary to demonstrate compliance?

21. Is it possible to propose and adopt a new standard and the implementation rule and/or guidance at the same time? If so, can you commit to adopting the new standard and the implementation rule and/or guidance at the same time? Why or why not?

22. Does EPA have any plans for addressing methane – particularly in regards to midstream and upstream oil and gas production?

Environmental Health Claims

23. EPA estimates that reductions in particulate matter (PM) will prevent 230,000 to 490,000 early deaths making PM exposure between the first to third highest risk factor for mortality in the U.S. in 2020.

    Will you commit to reviewing these analyses with the CDC and other health agencies to get support for these claims?

New Source Performance Standards for Power Plants

24. In a memo to the broader Science Advisory Board on Nov. 12, the SAB Work Group charged with reviewing EPA's major rulemaking actions recommended a review of science underpinning the NSPS proposal. Specifically, the Work Group highlighted concerns that the underlying science lacked adequate peer review. Subsequently, at a SAB board meeting Dec. 4-5, EPA representatives argued against the Work Group's recommendations. In light of these developments, we respectfully request that you make available to the Committee the following information:

- All written communications between those EPA employees the SAB or the SAB Work Group concerning peer review of any studies that the proposed standards relied on.

- A record of all peer review of any studies that the proposed standards relied on.

- EPA's intentions regarding the need for further peer review of any such studies and whether EPA intends to withdraw its reliance on any of those studies in promulgating the performance standards.

- All records of any SAB or the SAB Work Group review of or input into the proposed standards. If EPA did not solicit this input, please explain why not.

- EPA's intentions regarding future SAB or SAB Work Group input into the proposed standards. If EPA does not intend to solicit this input, please explain why not.

- All records of any SAB or SAB Work Group input into EPA's development of regulations under Section 111(d) of the Clean Air Act pertaining to existing fossil-fuel-fired electric generating units or SAB or SAB Work Group consideration of such regulations.

- EPA's intentions regarding future SAB or SAB Work Group input into these existing unit regulations. If EPA does not intend to solicit this input, please explain why not.

25. Since EPA claims no one is expected to build a new coal plant in the near future, could EPA wait 8 years until the next review of NSPS to allow greater time for determination as to whether CCS is adequately demonstrated for new coal plants? If so, why does EPA see the need to determine whether CCS is adequately demonstrated before this time, seeing as no NGU's will be built before then?

Economic Modeling Commitment

26. Since 1977, section 321(a) of the Clean Air Act (CAA) has required "the Administrator to conduct continuing evaluations of potential loss or shifts of employment which may result from the administration or enforcement of the provision of [the Clean Air Act] and applicable implementation plans, including where appropriate, investigating threatened plant closures or reductions in employment allegedly resulting from such administration or enforcement." The §321 requirement is different than the requirement from Executive Order 12866 that EPA consider in a Regulatory Impact Analysis (RIA) what impact a single proposed rule will likely have on jobs. For §321, EPA has to consider the impact that existing CAA requirements – taken as a whole – have had on job losses and shifts in employment throughout our economy. RIAs, by contrast, only consider the potential future employment impact that a single proposed rule will have. Therefore, EPA's

preparation of RIAs for new rules does not satisfy §321(a). EPA has never conducted a section 321(a) study to consider the impact of CAA programs on jobs and shifts in employment.

- Why has EPA not conducted a study to consider the impact of CAA programs on job shifts and in employment?

- Will EPA commit to conducting such studies in the future?

27. EPA committed to convene an independent panel of economic experts experienced with "whole-economy" modeling to evaluate whether EPA's current economic modeling adequately measures the employment impacts of rules.

    - Why has the EPA not convened such an independent panel?

    - Does EPA have plans of convening this panel in the future? If so, when?

Sue and Settle

28. During Senate confirmation as EPA Administrator on July 9, 2013, you agreed to undertake four action items: (1) improve Freedom of Information Act (FOIA) training for EPA employees, (2) publicly release the scientific information EPA used to set nationwide air quality standards, (3) study whether EPA needs to conduct more thorough economic analyses of the employment impacts of its regulations, and (4) to publish on two websites the Notices of Intent to Sue (NOIs) and Petitions for Rulemaking (PFRs) received by the agency.

    - What steps have you taken since your confirmation to improve the transparency of this process and allow affected parties, including states and industry, to participate in the process, including settlement negotiations, to ensure that all interests are represented?

    - As EPA Administrator, what steps are you taking to ensure that the agency does not agree to deadlines through settlements that do not provide sufficient time for EPA to meet its obligations under the Administrative Procedure Act, the Regulatory Flexibility Act, the Small Business Regulatory Enforcement Fairness Act, OMB Circular A-4, and other requirements that apply to EPA?

29. In a denial earlier this year of several environmental groups' petition for a rulemaking under the Clean Air Act, Acting Administrator Robert Perciasepe stated that, "[e]ven under the best circumstances, the EPA cannot undertake simultaneously all actions related to clearly determined priorities as well as those requested by the public, and so the agency must afford precedence to certain actions while deferring others.... The EPA must prioritize its undertakings to efficiently use its remaining resources."

In your view, do new commitments that EPA agrees to in "sue and settle" agreements with environmental groups, including timetables for rulemakings, have an impact on EPA's priorities as to the rulemakings that it undertakes? Have they had an impact on EPA's budgetary resources?

Tier 3

30. Did EPA proceed with the Tier 3 rule to satisfy an agreement during the CAFE negotiations?

Integrated Risk Information System

31. IRIS assessments released at the evidence table stage come without context and the public lacks knowledge regarding EPA thoughts regarding endpoints of concern, modeling and critical literature. As such, within just 60 days, the public must review hundreds of studies to provide comments to EPA on their quality, acceptability and suggested use. This may be placing a heavy burden on stakeholders who wish to engage the EPA.

    Do you believe changes could be made to this approach that might benefit stakeholders? If so, what changes do you think stakeholders might benefit from most?

32. EPA has released a complete draft Benzoapyrene assessment for 60 day peer review. Upon request, EPA did extend the comment period for another 30 days. However, the document and supporting information is over 500 pages and the public did not benefit from any review of evidence tables. There were no earlier discussions with EPA about critical studies.

    Why didn't EPA share some of the preliminary information with the public before releasing a completed draft assessment?

33. Will you ensure that as part of the improvements in the IRIS program, the Agency will move away from outdated default assumptions and instead always start with an evaluation of the data and use modern knowledge of mode of action—how chemicals cause toxicity—instead of defaults?

34. To further improve the IRIS Program, can you commit to revising the way hazard values are presented to the public to ensure that critical science policy assumptions are transparently presented and not comingled with scientific assumptions?

35. What are natural environmental chemical levels? What are background, man-made chemical levels?

    - How do you consider these levels in IRIS determinations?

- How do IRIS hazard values accommodate levels associated with existing natural exposures that are not known to be associated with any adverse effects at these low exposure levels?

36. Can you commit to ensuring that a 3rd party, independent of the IRIS Program, is tasked with ensuring that EPA staff have sufficiently considered and responded to peer reviewer and public input before assessments and other documents are finalized?

Cross- cutting Risk Assessment Concerns:

37. Some scientists have suggested using a weight of evidence framework that incorporates relevant and reliable data along with knowledge of hypothesized modes of action, so that there is a clear and objective presentation of the extent to which existing data and knowledge do, or do not, support each hypothesis, including the default.

    Do you support such an approach? If so, can you provide us with a timeline for such an approach might be adopted within OPPT and IRIS?

38. One of the biggest challenges for risk assessment is the insistence by some international regulators to use hazard as a surrogate for risk in regulatory decision-making.

    When EPA personnel participate in international forums where these issues are being discussed (e.g., OECD, APEC, SAICM, etc.) will you encourage them to advocate that risk be used as the basis for human health and environmental policy development?

39. EPA's IRIS program completes no more than 10 assessments per year. Since 1999 the Canadian government has evaluated about 23,000 chemicals as part of its chemical management plan. By 2006, all 23,000 chemicals had been evaluated and about 4,000 chemicals were identified as requiring further review. Since then Canada has been systematically reviewing these 4,000 substances and has thus far identified a list of Priority Substances considered "toxic" under the criteria laid out in legislation for which management plans are to be created.

    - Does EPA have the capacity to review the same number of chemicals in the same time period as the Canadian government?
    - What did the Canadian government find that disagrees with EPA findings?
    - What is EPA doing to streamline the chemical assessment process?
    - Would you agree that the IRIS program can do better, and that some fundamental changes are necessary?
    - What changes do you believe should be made to the IRIS program?

- Do you support broad discussions with stakeholders to re-think the IRIS framework and approach?

Questions Regarding ORD Nominee Thomas Burke:

40. Thomas Burke suggested in an NAS report he chaired that information on nonchemical stressors should be incorporated into assessments and EPA should further research dollars into evaluating the interactions between chemical and nonchemical stressors.

    - Do you believe that EPA has the staff, with requisite qualifications, and financial capacity to also take on evaluations of nonchemical stressors?
    - Should EPA convince Congress, NAS, and all other stakeholders that they can appropriately evaluate chemical stressors before broadening their scope to include evaluation of chemical stressors?

Grant Funding – Conflict of Interests

41. In response to questions you stated that you have a process in place to review the eligibility of EPA grant recipients serving on peer review panels. When was this review process put into place?

42. Did EPA review in detail the grants that were obtained by current CASAC panel members and consultants to determine if there is was a potential conflict?

    - If so, who within EPA has conducted this review?
        - What does the grant review involve?
        - Are grants to the potential member's institution also reviewed?
        - Can EPA share the results of this grant review with the Committee?

    - If EPA has not done the detailed review of the individual grants of CASAC panel members and consultants, why not? When will EPA conduct this review?

    - Under what specific circumstances would EPA conclude that a grant recipient should not serve on a peer review panel?

43. When EPA appointed Dr. Jonathan Samet to be chair of the CASAC panel reviewing the PM2.5 NAAQS, did EPA review EPA grants to Dr. Samet and his affiliated research institutions for a potential conflict?

- How far back did the evaluation go?

- What was the total amount of EPA funding provided to Dr. Samet and his research institutions in the five years leading up to his appointment?

- If EPA grants were provided, what areas of research did the grant funding cover?

- Did any of the grants address PM2.5 or ozone NAAQS related science?

44. EPA's Peer Review Handbook states that experts that have made public pronouncements on an issue may lack impartiality and should be avoided; and that individuals who have "taken sides" should be avoided. According to the recently released IG Report on EPA's management of CASAC, in 2008, EPA selected Jonathan Samet as Chair of CASAC to review the PM2.5 standard even though he had published an article in 2006 opposing EPA's current PM standard. The IG Report stated that Dr. Samet failed to disclose the public statement in the disclosure form that specifically asked if he *"made any public statements, written or oral, on the issue that would indicate to an observer that you have taken a position on the issue under consideration."* According to the IG Report, CASAC members are also required to update this form annually and to participate in an ethics training course.

    - Did the SAB staff review Dr. Samet's publications to see if a public statement had been made?

    - Has anyone at EPA asked Dr. Samet why he omitted this important information despite a direction question on his form?

    - Did Dr. Samet submit a new financial disclosure statement annually while Chair? If so, did he continually omit disclosure of his public statements on all his forms?

45. Does EPA normally review publications of CASAC members and consultants to determine if public statements have been made?

Data Transparency

46. In answering member questions, you stated that in response to the Shelby Amendment on data access, you have assured yourself that you have access to the underlying research data.

    Does this include the confidential cohort data?

47. According to OMB grant policies (Circular A-110) that were in place before and after the Shelby Amendment, federal agencies have the right to "obtain, reproduce, publish or otherwise use the data first produced under an award," and authorize "others to receive, reproduce, publish, or otherwise use such data for Federal purposes". This broad authority (__.36(c)(1)&(2)) is unrelated to Freedom of Information Requests.

    Given that the American Cancer Society and Harvard Six City studies were funded by EPA, does the federal government have the ability to obtain the data that resulted from those grants under __.36(c)(1)&(2) of the A-110 Circular?

48. Can you provide us with a list of all the times EPA has obtained research data to conduct its own analysis?

49. Are there studies on PM2.5 and ozone studies that rely on publically available data sets? If so, please list those studies.

50. Will EPA commit to not rely on studies for setting standards that are based on underlying data sets and methodologies that neither EPA nor the public can access and review?

Questions Relating to the Use of Old Cohort Data

51. The individual cohort data from the American Cancer Society and Harvard University are over 30 years old. Because the data were collected over 30 years ago, the smoking rates of the individuals in the studies have stayed the same despite a dramatic fall in smoking nationally. Similarly, the assumptions about participants' use of heart medicine and cholesterol lowering drugs have not changed over these 30 years, despite the dramatic increases in their usage nationally.

    - Does EPA believe that the outdated nature of the individual cohort data used in studies that rely on the ACS and Harvard Six City cohort data create additional uncertainties and weaknesses that could be corrected if new cohort data were used?

    - Does EPA believe that the small but statistically significant decrease in deaths attributed to reduced PM2.5 exposures in these studies are, at least in part, due to reductions in smoking or increased use of medications that the studies are not addressing? If so, how can the EPA know what percent of the decrease in deaths attributed to reduced PM2.5 exposures are actually due to other factors?

Environmental Research, Development and Demonstration Authorization Act

52. The Environmental Research, Development and Demonstration Authorization Act of 1978, 42 USC § 4365 (ERDDAA) established the Science Advisory Board (SAB).
    a. Please explain in detail how you interpret the provisions ERDDAA.

b. Explain EPA's interpretation of ERDDAA's requirement that the "Administrator, at the time any proposed criteria document, standard, limitation, or regulation under the... [CWA]... is provided to any other Federal agency for formal review and comment, shall make available to the Board such proposed criteria document, standard, limitation, or regulation, together with relevant scientific and technical information in the possession of the Environmental Protection Agency on which the proposed action is based." *Id.*

c. Explain in detail the role and powers ERDDAA gives specific Congressional Committees. Do these powers include the ability to pose charge questions to the SAB? Why or why not? Do these powers include initiating the formation of new SAB panels to provide advice to Congress? Why or why not. Please cite any relevant statutory support for these positions and explanations.

d. Does the SAB have the independent power to initiate reviews? Why or why not?

e. What specifically is required to initiate reviews. How were these requirements determined?

QUESTIONS FOR THE RECORD
The Honorable Paul Broun (R-GA)
U.S. House Committee on Science, Space, and Technology

Strengthening Transparency and Accountability within the Environmental Protection Agency

Thursday November 14, 2013

IRIS Questions

1. You testified on November 14 that "The Agency's ability to pursue its mission to protect human health and the environment depends upon the integrity of the science upon which it relies. I firmly believe that environmental policies, decisions, guidance, and regulations that impact the lives of all Americans must be grounded, at a most fundamental level, in sound, high quality, transparent, science." Additionally, at the September 17, 2012 opening public meeting of the National Research Council (NRC) IRIS Review panel, EPA NCEA Director Dr. Ken Olden stated in his presentation, that "openness and transparency will be the hallmark [of IRIS assessments] going forward." At the same NRC meeting, EPA Acting IRIS Director Vince Cogliano informed the panel that "new [EPA IRIS] initiatives will increase transparency and promote involvement of the scientific community." Finally, the NRC Formaldehyde Report (2011), the committee noted in its recommendations to EPA for improving the IRIS process overall, "In the judgment of the present and past [NRC] committees, consideration needs to be given to how each step of the [IRIS] process could be improved and gains made in transparency and efficiency." (NRC Formaldehyde Report (2011), p. 164).

In order to understand the scientific underpinnings of many EPA documents, the public has been forced to resort to using FOIA, or other approaches, to try to obtain critical information and data that the EPA has relied upon. As these tools are time consuming and create legal hurdles, the information has not been available to the public in a timely manner to inform review and public comment.

- As part of a commitment to transparency and openness, do you agree that the data and information which underlies the key scientific studies the agency relies upon in important scientific reviews, assessments, and rulemakings (e.g., NAAQS Integrated Science Assessments, IRIS Toxicological Review), should be available to the public?

- Can you commit to making this information available in public dockets?

2. Industry and federal research efforts have invested millions to better understand how chemicals interact with biological systems at human exposure levels in order to ensure development of human health risk assessment prediction models that are as accurate and science-based as possible. However, EPA has a long track record of dismissing these types of scientific biologically-based models and asserting that such approaches cannot prove the defaults are not warranted. Demanding that science proves a negative is an

anti-scientific policy and indicates a deep seated prejudice against use of mode of action knowledge to replace defaults.

- Why shouldn't EPA use the most up to date knowledge on mode of action and dose response at environmentally relevant exposures in lieu of outdated default approaches for hazard identification and dose response throughout the Agency, including in the IRIS Program?

3. As EPA prepared to conduct a non-cancer toxicity assessment of Libby Amphibole Asbestos, it arranged by contract for development of additional data that EPA described as "for development of the most accurate RfC for the Libby site." These new data included advanced radiographic imaging and pulmonary function studies of the population from which the RfC would be derived. The new data were collected by the University of Cincinnati as planned, but after several years remain unpublished and undisclosed by the federal government. EPA has neither revealed its assessment of the data nor explained why it chose to prepare its draft toxicity assessment without citation to or disclosure of underlying data that was sought by EPA to ensure the accuracy of the RfC.

   - Please explain how EPA reconciles not disclosing the above data with its commitment to transparency and the NRC recommendation as noted above as well as the disclosure directives of FOIA and OMB Circular No. A-130 (Revised) which express the policy that the open and efficient exchange of scientific and technical government information supports the operation of democracy and excellence in scientific research.

   - If EPA asserts that it does not possess or have access to any portion of the data, for instance because the funding mechanism changed and someone else paid for it, please explain:

     a. In the interests of transparency and sound science, why EPA did not affirmatively obtain for its own use the data during RfC development, especially since EPA had described the data as needed "for development of the most accurate RfC."

     b. Which governmental agencies provided funding for the development of the data?

   - We understand that EPA received a Freedom of Information Act Request (FOIA) for the above data, and subsequently withheld a portion of the data based upon the deliberative process privilege. EPA explained by letter of November 1, 2013 that it was withholding the data because:

     The withheld documents, and portions of documents, are protected by the deliberative process privilege because they ***reflect the internal discussions, advice, analysis, and recommendations that***

were considered in developing the [IRIS] Assessment for Libby Amphibole Asbestos. *The records were created prior to the finalization of this IRIS Assessment. Furthermore, withheld records were not circulated outside the Agency.* ***Release of the withheld material would prematurely disclose proposed policies before they are finally adopted*** *and cause public confusion by disclosing reasons and rationales that were not in fact ultimately the grounds for EPA's final assessment.*

We further understand that the deliberative process privilege does not ordinarily cover scientific information and data, and "government researchers must be willing to expose the underlying data to public scrutiny." Chicago Tribune Co. v. United States Dep't of Health and Human Servs., 1997 U.S. Dist. 2308 at *52 (N.D. Ill. Feb. 26, 1997). In light of this, please explain how the deliberative process privilege protects against disclosure of data, and whether the data should be produced to the public under FOIA.

4. EPA is identifying the non-cancer adverse effect for the draft toxicological assessment of Libby Amphibole Asbestos as pleural plaques, asserting there is an association with certain functional impairment of the lung. It has come to our attention that the question of whether pleural plaques cause any clinically significant impairment is highly disputed and controversial. In light of this information:
    - Is EPA considering discarding the assertion that pleural plaques cause lung decrements or any other functionally significant impairment because this initially proposed basis for selecting pleural plaques as the adverse effect lacks the needed scientific support?

    a. If so, in the interest of transparency, please explain EPA's current position as to which adverse effect it is using for its non-cancer toxicological assessment, the basis for selecting that adverse effect, and whether the Agency will provide the opportunity for public comment on any change in its position.

5. Do you agree that all studies should be independently judged based on their quality, strength, and relevance regardless of the author affiliation or funding source?

6. Do you agree that chemicals associated with the human body's natural processes should be addressed specifically and separately in the development of an EPA hazard value or risk assessment?

7. An analysis presented at the Society of Toxicology meeting showed that 67% of the Hazardous Air Pollutants (HAPs) have no IRIS value.

    a. Do you believe that HAPs should be priorities for assessment within the IRIS Program?

    b. What are the criteria for selecting chemicals for assessment within the IRIS Program?

c. Can you commit to developing a clearly articulated prioritization process for high priority IRIS assessments that benefits from, and is responsive to, engagement from all stakeholders?

Utility MACT and Other Air Quality Issues

8. There are many groups that analyze the impacts of EPA regulations. In particular, most of these groups analyze job losses. These include, for example, job losses due to higher energy prices. How does EPA determine job losses that are caused by a proposed rule or a final rule? For example, do you use a model to determine job losses? When you analyze the job impacts of a rule that affects power plants -- for example, the Utility MACT rule that will cost $10 billion per year – does EPA analyze job losses in industries that have to pay higher energy prices?

9. In a 2012 letter, you stated that "the best scientific evidence… is that there is no threshold level of fine particle pollution below which health risk reductions are not achieved by reduced exposure." Do you believe that any of the criteria air pollutants under the Clean Air Act (ozone, lead, sulfur dioxide, nitrogen oxides, carbon monoxide, coarse particulate matter) have a threshold below which they are not harmful to human health (or may be beneficial)?

10. Last month, the World Health Organization classified outdoor air pollution as carcinogenic to humans. Do you think ambient air in America causes cancer?

11. According to the Office of Management and Budget, benefits from reducing particulate matter represent a majority of all benefits for all regulations across the entire federal government. Do you agree?

12. Your predecessor, Lisa Jackson, previously testified that "If we could reduce particulate matter to healthy levels, it would have the same impact as finding a cure for cancer." Cancer kills roughly 600,000 people in this country each year. Do you agree with Administrator Jackson's statement?

13. Will your Agency propose a new National Ambient Air Quality Standard for ozone before the end of 2014?

EPA's Second Peer Review on the Bristol Bay Assessment

14. In the development of the Agency's Bristol Bay Assessment, the Agency without soliciting any public input, asked the original twelve peer reviewers to give their opinions on how well the Agency responded to the comments that these peer reviewers made on the first draft of the Bristol Bay Assessment. Will you release the peer reviewers' comments now, before the final Bristol Bay Assessment is released? This will not in any

way prejudice the Assessment, and will be in keeping with your commitment to both transparency and sound science.

Climate Regulations

15. When EPA released its regulations on new power plants in September, they were criticized because they would have a negligible impact on climate change. However, you have repeatedly emphasized that if we get enough countries on board we can make a difference, and you have said that a key goal of EPA's rules is to help leverage some kind of international agreement.

    With that in mind, will you assure us that EPA will not take unilateral action on climate—which EPA itself acknowledges is not sufficient to make a measurable impact—but rather only proceed with rules if other major emitting countries like China agree to similar binding regulations? If not, why not?

16. In 2009, President Obama committed to the U.S. to reducing greenhouse gas emissions 17 percent below 2005 levels by 2020. If EPA's power plant regulations are implemented, will the U.S. achieve that goal?

    In accordance with the UN Climate Change Conference in Warsaw that concluded on November 23 with an agreement for additional cuts beyond 2020, the U.S. is expected to support additional reductions beyond the President's 2020 goal. What will EPA have to regulate in order to meet those commitments? In other words, does EPA intend to regulate natural gas-fired powered plants in order to meet these new commitments?

QUESTIONS FOR THE RECORD
The Honorable Larry Bucshon (R-IN)
U.S. House Committee on Science, Space, and Technology

Strengthening Transparency and Accountability within the Environmental Protection Agency

Thursday November 14, 2013

Definition of Fill Material

1. The current definition of fill material, finalized in May, 2002, unified the Corps and EPA's prior conflicting definitions to solidify decades of regulatory practice. However, both EPA and the Corps have stated that they are now considering revising the definition of fill material. Ken Kopocis at his nomination hearing pointed to the 2009 Supreme Court decision in *Coeur Alaska v. Southeast Alaska Conservation Council* as justification, stating that there is "remaining ambiguity regarding circumstances where discharges of fill material (e.g., mine tailings) may also be covered by an Effluent Limitation Guideline." Do you believe that such ambiguity exists, and will EPA be seeking to address that issue?

Water Quality Criteria – Conductivity

2. While EPA's conductivity "benchmark" that it had applied to Appalachian streams were set aside by the U.S. District Court for the District of Columbia in the case of *NMA v. Jackson*, EPA recently published several papers supporting its conductivity actions, and announced that it is developing a water quality criteria.
   a. Will EPA's new criteria be a regional criteria, or applicable nationwide?
   b. As is required by law, will EPA be applying its conductivity criteria to all CWA permits, regardless of industry?
   c. In the past, EPA has not addressed scientific critiques that have produced evidence that conductivity is not a good indicator of benthic/aquatic health. Going forward, what plans does EPA have to take this growing number of studies into account?

Selenium Water Quality Criteria

3. EPA is currently involved in a scientific assessment of Selenium that will be used to propose a new national Selenium water quality criterion. Yet, EPA constantly pushes back a potential release date for its proposal, which is causing uncertainty for operations nationwide.
   a. What is EPA's proposed release for a selenium water quality criteria?
   b. What is EPA's strategy for incorporating relevant scientific critiques and comments EPA receives into its final Selenium criteria?
   c. How is EPA taking the site-specific nature of Selenium issues into account when developing the national standard?

Court Cases – *National Mining Association v. Jackson*

4. The U.S. District Court for the District of Columbia in the case of *NMA v. Jackson* recently struck down several EPA actions – specifically, EPA's Enhanced Coordination Process (ECP) and Multi-Criteria Integrated Resource Assessment (MCIR) for Appalachia surface coal mining, as well as EPA's guidance document, "Improving EPA Review of Appalachian Surface Coal Mining Operations Under the Clean Water Act, National Environmental Policy Act, and the Environmental Justice Executive Order" – as violating the CWA and Administrative Procedure Act, as well as, in the case of the guidance document, the Surface Mining Control and Reclamation Act. In your confirmation hearing, you stated that the Agency has directed its field offices not to use the guidance documents affected by the court decision. However, very few mining permits have been issued since the decision.

   How does that outcome comport with the District Court's decision, and what additional steps do you think are needed to adhere to the District Court's decision?

Court Cases – *Mingo Logan Coal Co. v. EPA*

5. In March, 2012, the U.S. District Court for the District of Columbia struck down EPA's retroactive revocation of a mining-related CWA Sec. 404 permit, holding unequivocally that EPA has no authority to retroactively veto CWA Sec. 404 permits issued by the U.S. Army Corps of Engineers. However, EPA appealed that decision and in April of 2013, the U.S. Court of Appeals for the District of Columbia reversed the decision of the District Court.
   a. What do you think the practical effect on industry would be of having Sec. 404 permits be subject to EPA's veto even years after permit issuance and even if the permittee is in full compliance with the terms of the permit?
   b. During deliberations on the Clean Water Act in Congress, Senator Muskie noted that there are three essential elements to the Clean Water Act -- "uniformity, finality, and enforceability". How do the assertions made by EPA regarding the scope of its authority under Sec. 404 comport with the notion of permit finality? How have you, pursuant to your testimony at your confirmation hearing, worked to implement the CWA to provide uniformity, finality and enforceability?

Bristol Bay Draft Watershed Assessment

6. In response to petitions from environmental organizations to initiate a 404(c) veto process for a potential mine site in Bristol Bay before a permit application was submitted, EPA – pointing to its authority under CWA Sec. 104 – initiated a draft watershed assessment that involved the crafting of a hypothetical mining scenario in Bristol Bay.
   a. EPA has stated that the assessment will not have any legal consequences, but also that it is intended to provide a scientific and technical foundation for decision-making. How exactly does EPA intend to utilize this study under your leadership?
   b. EPA has full authority under the well-established Sec. 404 process to review any future permit application submitted to make a determination as to whether or not there will be any of the unacceptable adverse effects listed in CWA Sec. 404(c) at the disposal sites being considered by the U.S. Army Corps of Engineers, including unacceptable impacts to fishery areas and wildlife. Why, then, is EPA using its limited resources to conduct a

watershed assessment on a hypothetical mining scenario that even EPA's scientific review panel found did not accurately reflect the conditions of a real mine, rather than allow the companies that have invested millions of dollars to submit their proposal which EPA would then review?

c. What impact do you think EPA's actions with respect to Bristol Bay will have on investment in U.S. property and natural resource development?
d. Has EPA considered the positive environmental justice impacts high-paying jobs and tax revenue will have on the region?

QUESTIONS FOR THE RECORD
The Honorable Steve Stockman (R-TX)
U.S. House Committee on Science, Space, and Technology

Strengthening Transparency and Accountability within the Environmental Protection Agency

Thursday November 14, 2013

Interagency Taskforce on Development of Unconventional Natural Gas Resource

Background Statement on Task Force:

- On April 13, 2013, the President signed an executive order (EO) forming an interagency Task Force to support the safe and responsible development of unconventional natural gas resources
- In the Policy section of that EO the president states that "it is vital that we take full advantage of our natural gas resources" while doing it safety.
- The EO outlines the function of the Task Force as coordinate agency policy activities, sharing scientific and economic information, long-term research and infrastructure planning and consultation among agencies
- EPA is a member of that task force at the Deputy level according to the EO.

Questions:

1. Mrs. McCarthy, who is EPA's representative to this Task Force and how often does it meet?
2. Have you personally been briefed on the Task Force activities?
3. Can you provide an update to this Committee today on EPA's activities and focus areas as a member of this Task Force?
4. There are a number of Executive Branch departments and agencies engaged in some fashion in unconventional resource development. Can you provide your opinion on the level of coordination on policy activities, sharing of information and, in particular, and your thoughts on long-term research in the area of infrastructure planning?
5. Last week, Interior Secretary Jewell said that there is a lot of misinformation about fracking and that quote ""Fracking has been done safely for many, many years,"
   a. Do you agree with Secretary Jewell that fracking has been done safely for many years?
   b. What parts of the fracking process do you feel are being done safety?
   c. Are there any parts of the fracking process that you feel are not safe?

Credibility and Ability of EPA Science

Background Statement on EPA Science

- In 2009 legislation, Congress directed EPA to conduct a study on hydraulic fracturing and groundwater.
- Rather than following the statute – how HF affects groundwater –EPA has outlined a sprawling study plan that goes well beyond groundwater issues.
- EPA initially did not recognize this as a "highly influential" study subject to OMB's Peer Review Bulletin, has not been able to garner an industry partner in conducting perhaps the most important aspect of its study plan – the "before and after" prospective study, and also had an EPA science debacle when its scientists independently pursued research in Pavillion, WY.
- Today, at the end of 2013, EPA still has not issued the study and we are told not to expect it until 2016.

Questions:

1. Can you please describe for us what happened with the study of effects of hydraulic fracturing on water? Why it got so far off course, and what EPA is doing to get this effort back on track? What do you think this says about the state of EPA's science process and its ability to be timely and relevant?
   a. Can you please explain the decision to conduct a sprawling study rather than investigate the narrow question Congress posed?
   b. Can you please explain the initial decision not to designate this study as a "highly influential" document subject to OMB's Peer Review process?
   c. I am concerned that EPA has not been able to get any industry partners for the before-and-after prospective study. Can you please explain the apparent impasse between EPA and industry stakeholders on this issue? Can you please describe the issue around protocols around the study that we hear is one source of friction between EPA and industry?
   d. I would note that the University of Texas, EDF, and 9 companies partnered for a landmark study to look at emissions from oil and gas operations. That study took about a year. This tells me that industry partnerships are possible and that your agency should be able to find common ground with industry to conduct the study.

EPA's Role in Assuring the Public that Fracking is Safe

Background Statement on EPA's Role in Public Confidence:

- In that same interview last week, Secretary Jewell called on industry to educate the public on the safety of hydrofracking
- I agree, and it would seem to me that industry is trying to do just that:
  - Industry is participating with NGOs and academics to confirm the low emission rates of methane
  - Industry is implementing more stringent standards for drill sites, well bores and air emissions
  - Industry is working with states to implement more stringent regulatory requirements to further assure the safety of their operations
  - Industry has stepped up to the plate to try and educate the public on the safety of their operations

- However, EPA has not been so helpful:
  - You publish ground water contamination studies that are then discredited and withdrawn
  - You don't rebut flawed air emission studies that report methane emissions an order of magnitude higher than EPA's estimates
  - Last week in testimony before the Senate EPW, your Director of Atmospheric Programs (Ms. Sarah Durham) couldn't even make a positive statement about the UT/EDF air emissions study that basically confirmed EPA's estimate of emission from unconventional gas development operations

Questions:

1. Mrs. McCarthy, what role do you see EPA playing in assuring the public that unconventional gas development, development that President Obama supports, is safe?
2. Do you agree that EPA mis-steps around groundwater contamination can lead to a loss of public confidence?
3. Do you agree that failure to acknowledge reports confirming your own emission estimates and failure to discredit obviously flawed reports can lead to a loss of public confidence?
4. Can you see how EPA's silence on the wide range of hydrofracking issues being debated can lead to a loss of public confidence?
5. Secretary Jewell, less than 6 months into the job, is trying to instill some confidence with the public on hydrofracking – isn't it time EPA do so as well?

Clean Air Science Advisory Committee Transparency and Accountability Issues

Background

- On September 11, the EPA Inspector General released a final report titled *"EPA Can Better Document Resolution of Ethics and Partiality Concerns in Managing Clean Air Federal Advisory Committees"*.
- The report raised a number of alarming issues regarding the operation of EPA's Clean Air Science Advisory Committee (CASAC) and leaves many unanswered questions.
- CASAC is the advisory committee that during the past five years has recommended dramatic reductions in standards for nitrous oxides, sulfur oxides, particulate matter and ozone.
- The current ozone standard is under review again by CASAC and they are expected to make yet another recommendation to dramatically lower the ozone standard.

CASAC Financial Conflicts of Interest and Independence

Background on Financial Conflicts of Interest and Independence:

- CASAC members and contract advisors, or research institutions they are affiliated with, receive substantial grants from EPA for air quality research.
- In one case, Dr. Jonathan Samet, or his affiliated research institutions received almost $30 million dollars in EPA grants for research; Dr. Samet was the chair of the PM CASAC and currently serves on the ozone CASAC.
- In fact, several serving CASAC members have received over $1 million dollars from EPA for research.
- The IG Report confirms that a CASAC member's research grant is a potential area of concern if the Committee plans to address work performed under the research grant.
- Despite the millions in grant funding to CASAC members, it is unclear from the Report whether anyone actually investigated to see if those grants compromised their independence.
- The IG also found 9 instances where steps taken to mitigate independence or partiality matters were either not adequately documented or needed additional steps to sufficiently address potential independence or partiality concerns.
  - This included two instances where CASAC members contributed to studies or sections of CASAC reports under review by the CASAC panel creating a situation where they were opining on their own work

Questions:

1. Mrs. McCarthy, it's hard to know where to start. EPA is selecting advisors that are receiving millions of dollars from EPA for research. According to the IG Report, some of the selected advisors were also found to be reviewing or opining on elements of their own work; and that the Agency is not following existing agency procedures regarding conflicts of interest, or taking steps to mitigate issues when they are identified. What

steps is EPA taking in light of the IG Report to assure that the current CASAC ozone panel is impartial?
2. Please explain to me why the CASAC recommendation last year to lower the PM standard, a recommendation the EPA took, was not biased or not independent given these serious findings by the IG?
3. Will you commit here today not to select CASAC members and consultants that receive EPA funding for NAAQS related air quality research? There are certainly plenty of qualified individuals out there not on EPA's payroll.

CASAC Lack of Impartiality

Background:

- Federal ethics regulations require CASAC members to avoid appearances of a lock of impartiality.
- EPA's Peer Review Handbook states that experts that have made public pronouncements on an issue may lack impartiality and should be avoided; and that individuals who have "taken sides" should be avoided.
- In 2008, EPA selected Jonathan Samet as Chair of CASAC even though he had published an article in 2006 opposing EPA's current PM standard.
- As Chair of CASAC, Dr. Samet presided over the review of the PM standard and made recommendations to lower the PM standard.
- Dr. Samet failed to disclose the public statement in the disclosure form that specifically asked if he *"made any public statements, written or oral, on the issue that would indicate to an observer that you have taken a position on the issue under consideration."*
- CASAC members are also required to update this form annually and to participate in an ethics training course.

Questions:

1. Has anyone at EPA asked Dr. Samet why he omitted this important information despite a direction question on his form?
2. Did Dr. Samet submit a new financial disclosure statement annually while Chair? If so, did he continually omit disclosure of his public statements on all his forms?
3. Did Dr. Samet participate in all the required ethics training courses?
4. Why did the SAB staff not check his publication list to see if a public statement had been made?
5. Why aren't the financial disclosure forms (in whole or part) made public to allow the public to assist in reporting financial or potential impartiality conflicts?
6. If EPA had known, would the SAB staff have avoided Dr. Samet's appointment as Chair of CASAC?
7. Should EPA have a clearer policy of not appointing a person to a scientific advisory committee like CASAC if conclusive information has been provided showing a public statement has been made that suggests a clear bias (or removing them, if the evidence emerges after they have been appointed)?

8. Given that the Chair of CASAC was clearly biased in his opinion prior to serving as Chair of the PM CASAC panel, did his participation undermined the ability of CASAC to provide independent advice during the 2012 PM review? Does that compromise the scientific validity of the resulting NAAQS?

QUESTIONS FOR THE RECORD
The Honorable Dan Lipinski (D-IL)
U.S. House Committee on Science, Space, and Technology

Strengthening Transparency and Accountability within the Environmental Protection Agency

Thursday November 14, 2013

1. According to the EPA Inspector General, EPA violated Section 1605 of the American Recovery and Reinvestment Act, which plainly requires all public works projects funded by ARRA to use iron, steel, and manufactured goods that are produced in the United States. The IG found that submersible pumps and centrifugal blowers for wastewater treatment plants in Illinois were purchased from foreign companies that control no manufacturing facilities in the U.S. In addition, EPA has claimed that payments to American lawyers and marketing firms made these goods Buy American compliant. This incorrect interpretation of the law was perhaps the most disconcerting part of this incident because it could lead to future similar violations of Buy American laws. Can you tell me what steps the EPA has taken since this incident, and will take in the future, to prevent similar incidents? How will EPA ensure it doesn't spend taxpayer dollars on foreign goods when that money could be spent on American made items?

2. A constituent company in my district, Seeler Industries, has had questions about enforcement of regulations made under the General Duty provision of the Clean Air Act. As you know, under the General Duty provision, companies have a general duty to maintain a safe facility preventing and minimizing the effects of releases of extremely hazardous substances. I completely support the principle behind this provision, but in practice this company has found that regional EPA inspectors have a wide authority to enforce the provision as they see fit. In addition, according to the company, the rules under the general duty provision may run counter to rules promulgated by DHS for chemical safety. What are you doing to make clear to chemical companies what the requirements are for compliance with the general duty provision? What are you doing to clarify jurisdictional issues between EPA and DHS on chemical safety?

QUESTIONS FOR THE RECORD
The Honorable Mark Takano (D-CA)
U.S. House Committee on Science, Space, and Technology

Strengthening Transparency and Accountability within the Environmental Protection Agency

Thursday November 14, 2013

Thank you for your testimony before the House Committee on Science, Space, and Technology on November 14, 2013. I appreciated learning more about your work at the Environmental Protection Agency, particularly your efforts to protect public health through enforcement of the Clean Air and Clean Water Acts.

On the subject of clean water, I have additional questions pertaining to the proposed regulations that seek to clarify the bodies of water that should be subject to Clean Water Act jurisdiction. The EPA recently issued a draft scientific report on the connectivity of water, which remains under review by the Science Advisory Board. This report will serve as the scientific foundation for the proposed regulation.

As a member who represents a Southern California district, it is important that the members of the SAB who are putting together this report have an understanding of the water issues in the arid West. As you know, the water challenges and issues we face are vastly different from the Eastern and Midwestern parts of the U.S.

- What steps did the Agency take to ensure that the makeup of the SAB is "regionally" balanced and, more specifically, includes members who have a working understanding and knowledge of Western water issues?

Recently, a document surfaced that appears to be the proposed water connectivity regulation that OMB is currently reviewing. If this is the proposed rule that was put forth by EPA and the US Army Corps of Engineers, it would appear that all tributaries will be considered waters of the U.S. subject to regulation under the Clean Water Act. I have heard concerns that the language of the proposed rule could be broadly interpreted to encompass water conveyance and delivery systems.

- I have heard concerns that under the proposed rule it would be possible that the California Aqueduct and other features of California's vast water delivery system would be considered tributaries to be regulated under the Clean Water. Is that your understanding, and how will it affect water delivery for tens of millions of Californians?

Thank you for your attention to my questions. I look forward to your response and continuing to work with you to protect our environment.

Attachment B

THE FUTURE OF COAL: UTILIZING AMERICA'S ABUNDANT ENERGY RESOURCES

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

JULY 25, 2013

Serial No. 113–44

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CONTENTS

Thursday, July 25, 2013

THE FUTURE OF COAL: UTILIZING AMERICA'S ABUNDANT ENERGY RESOURCES

THURSDAY, JULY 25, 2013

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittee met, pursuant to call, at 9:36 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Cynthia Lummis [Chairwoman of the Subcommittee] presiding.A

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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WASHINGTON, DC 20515–6301
(202) 225–6371
www.science.house.gov

Subcommittee on Energy

The Future of Coal: Utilizing America's Abundant Energy Resources

Thursday, July 25, 2013
9:30 a.m. – 11:30 a.m.
2318 Rayburn House Office Building

Witnesses

Mr. Chris Smith, Acting Assistant Secretary for Fossil Energy, Department of Energy

Mr. Ben Yamagata, Executive Director, Coal Utilization Research Council

Mr. Don Collins, Chief Executive Officer, Western Research Institute

Ms. Judi Greenwald, Vice President, Center for Climate and Energy Solutions

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY

HEARING CHARTER

The Future of Coal: Utilizing America's Abundant Energy Resources

Thursday, July 25, 2013
9:30 a.m. – 11:30 a.m.
2318 Rayburn House Office Building

PURPOSE

The Subcommittee on Energy will hold a hearing entitled *The Future of Coal: Utilizing America's Abundant Energy Resources* on Thursday, July 25, at 9:30 a.m. in Room 2318 of the Rayburn House Office Building. The purpose of the hearing is to examine coal-related technology challenges and opportunities, with an emphasis on enhancing the effectiveness and impact of Department of Energy research and development (R&D) activities,[1] including DOE's R&D priorities as well as Federal government and private industry investments.

WITNESS LIST

- **Mr. Chris Smith,** Acting Assistant Secretary for Fossil Energy, Department of Energy
- **Mr. Ben Yamagata,** Executive Director, Coal Utilization Research Council
- **Mr. Don Collins,** Chief Executive Officer, Western Research Institute
- **Ms. Judi Greenwald,** Vice President, Center for Climate and Energy Solutions

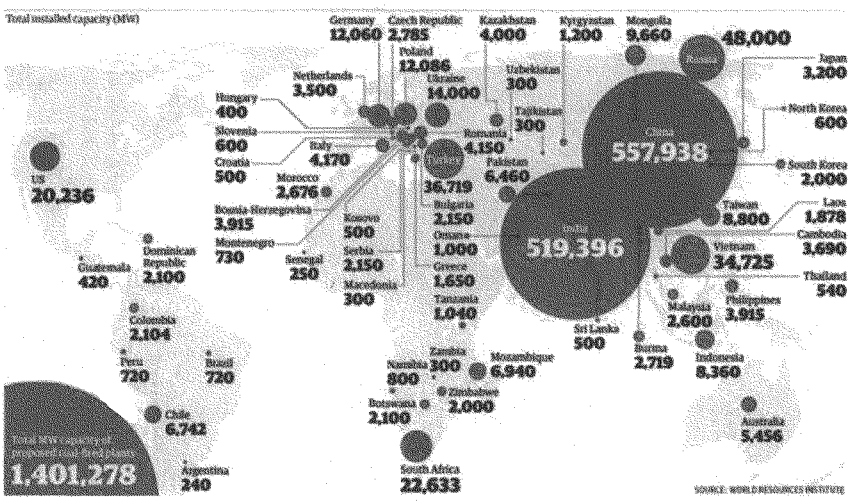
BACKGROUND

Coal currently generates approximately 40% of U.S. electricity, down from just under 50% in recent years.[2] The Energy Information Administration (EIA) projects nationwide demand for electricity will increase 28% through 2040, with coal's share of electric generation dropping to 35%. According to the World Resources Institute, total global proposed installation of coal-fired power plants is 1,401 gigawatts. The majority of these planned installations will be in India and China (Figure 1).

[1] For more information on coal-fired power plants, see Committee on Science Space and Technology hearing *"Advancing Coal research and Development for a Secure Energy Future"* October 13, 2011. Accessible at: http://science.house.gov/hearing/energy-and-environment-subcommittee-hearing-advancing-coal-research-and-development-secure

[2] Energy Information Administration, *"Annual Energy Outlook 2013,"* April 2013. Accessible at: http://www.eia.gov/forecasts/aeo/

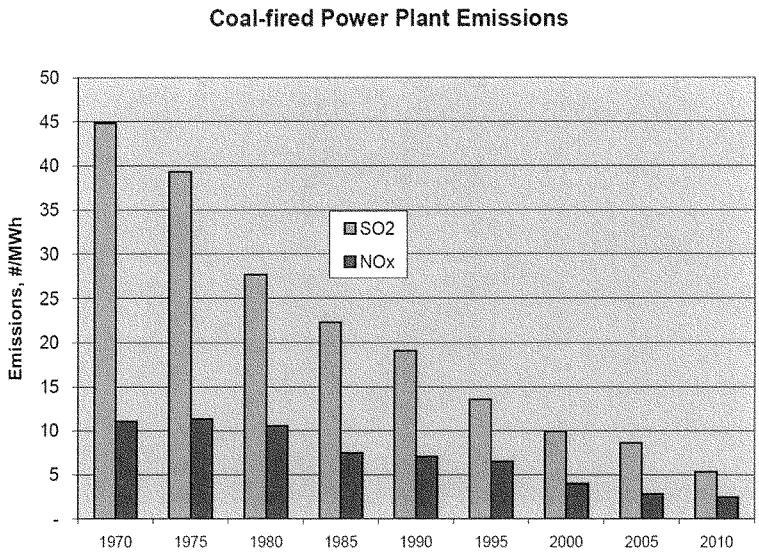
Figure 1: Proposed Coal-Fired Power Plants[3]



In recent decades, steady improvements to coal-related generation technologies have contributed significantly to increased efficiencies at power plants, a reduction of pollutant emissions (Figure 2), and reductions in water usage. For example, new power plants can handle higher temperature steam cycles, which increases efficiency to greater than 40% (up from approximately 30% for older plants). These improvements result in reduced environmental impacts per unit of electricity generated.

[3] The Guardian, *Which countries are planning the most coal-fired power plants?* November, 20, 2012. Accessible at: http://www.guardian.co.uk/environment/picture/2012/nov/20/which-countries-most-coal-power

Figure 2: Historical Coal Plant Emissions[4]



Department of Energy Coal Research and Development Activities

The Department of Energy funds a variety of coal research, development, and demonstration (RD&D) activities. DOE's Office of Fossil Energy (FE) is the primary office supporting coal RD&D. DOE FE's coal program mission is to "support secure, affordable, and environmentally acceptable near-zero emissions fossil energy technologies."[5]

In fiscal year 2013, DOE is supporting $495 million in fossil energy research and development activities, of which $370 million is directed to coal research, development and demonstration activities (Table 1). This funding is distributed between carbon capture ($69 million), carbon storage ($116 million), advanced energy systems ($100 million), and cross-cutting research activities ($49 million).

---

[4] *The CURC-EPRI Coal Technology Roadmap*, August 2012: Update, p. 9. Accessible at: http://www.coal.org/userfiles/file/FINAL%20Roadmap%20Report%20Update%20-%20August%202012%20(graphics%20and%20links).pdf

[5] Department of Energy, *"Department of Energy Budget Request Fiscal Year 2014, Volume 3"* p. FE-13, April 2013. Accessible at: http://energy.gov/sites/prod/files/2013/04/f0/Volume3_1.pdf

Table 1. Department of Energy (DOE) Fossil Energy Research and Development Spending

(dollars in millions)

Program	FY 2012 Current	FY 2013 Annualized CR	FY 2014 Request	FY 2014 House Energy & Water Bill	FY 2014 Senate Energy & Water Bill	FY 2014 Request versus FY 2012 Enacted	
						$	%
Coal							
CCS and power systems							
Carbon capture	*67.0*	*69.3*	*112.0*	*68.9*	*N/A*	*+45.0*	*+67.2%*
Carbon storage	*112.2*	*116.1*	*61.1*	*79.3*	*N/A*	*-51.1*	*-45.6%*
Advance energy systems	*97.2*	*100.6*	*48.0*	*91.7*	*40.0*	*-49.2*	*-50.6%*
Cross cutting research	*47.9*	*49.4*	*20.5*	*30.9*	*N/A*	*-27.4*	*-57.2%*
NETL coal research and development	*35.0*	*35.2*	*35.0*	*45.0*	*N/A*	*0*	*N/A*
Total, CCS and power systems	*359.3*	*370.7*	*276.6*	*315.9*	*268.6*	*-82.7*	*-23.0%*
Total, Fossil Energy R&D*	***337.1***	***495.0***	***420.6***	***450.0***	***420.6***	***+83.5***	***+24.8%***

* Total includes natural gas technologies, unconventional fossil energy technologies, program direction and use and rescission of prior year balances.

DOE also maintains a portfolio of major Carbon Capture and Sequestration (CCS) demonstration projects originally funded through the American Recovery and Reinvestment Act (Appendix A). Additionally, the Clean Coal Power Initiative (CCPI)—initiated in 2002 as a "cost-shared partnership between the Government and industry to develop and demonstrate advanced coal-based power generation technologies at the commercial scale"—has funded 18 projects, four of which remain currently active.[6]

DOE Advanced Fossil Energy Loan Guarantees

On July 2nd, the Department of Energy (DOE) announced a draft loan guarantee solicitation for advanced fossil energy projects and facilities.[7] The solicitation includes $8 billion in loan guarantees, authorized through section 1703 of the Energy Policy Act of 2005. The loan guarantees are intended to reduce greenhouse gas emissions and other air pollutants by financing the construction of advanced technology fossil energy projects and facilities. These include projects in areas such as advanced resource development, carbon capture, low-carbon power systems, and efficiency improvements with the goal to reduce emissions of carbon dioxide, methane, and other greenhouse gases.

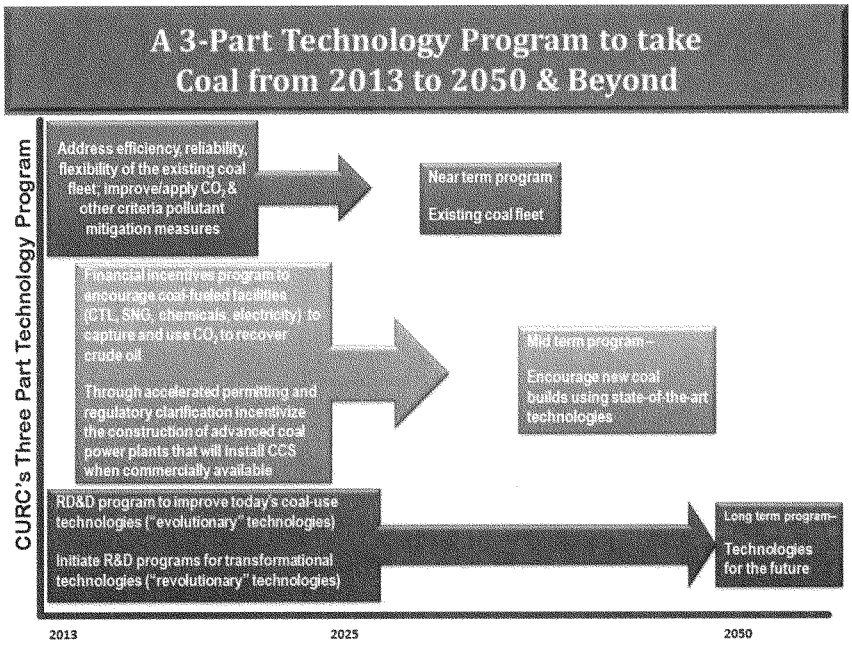
[6] Department of Energy, "Major Demonstrations: Clean Coal Power Initiative" Accessible at: http://www.netl.doe.gov/technologies/coalpower/cctc/ccpi/#

[7] Department of Energy, *"Energy Department Releases Draft Advanced Fossil Energy Solicitation to Support Reductions in Greenhouse Gas Pollution,"* July 2, 2013. Accessible at: http://energy.gov/articles/energy-department-releases-draft-advanced-fossil-energy-solicitation-support-reductions

Coal Technology Roadmap

In August 2012, the Coal Utilization Research Council (CURC) and Electric Power Research Institute (EPRI) updated their "*Coal Technology Roadmap*,"[8] originally drafted in 2000 and updated in 2008. The Roadmap "describes technologies needed to acquire a set of benefits from coal that each organization views as important and achievable through advancements in technology." The Roadmap identifies research, development and demonstration activities in various timeframes to reduce criteria pollutant emission, improve power plant efficiency, reduce water demand and discharge, and identify transformational technologies to reduce greenhouse gas emissions (Figure 3).

Figure 3: CURC/EPRI Coal Technology Roadmap Summary



[8] CURC/EPRI Coal Roadmap

Pending Regulatory Issues

On June 25, President Obama issued a Presidential memorandum directing the Environmental Protection Agency (EPA) to regulate greenhouse gas emissions from new and existing power plants.[9] Prior to this directive, the EPA had already taken steps to regulate greenhouse gas emissions from power plants. Last year, the EPA issued greenhouse gas New Source Performance Standards for new Electric Generating Units, which established carbon dioxide emissions standards for new fossil-fired power plants. These regulations would effectively limit the operation of existing or construction of new coal-fired power plants that do not have CCS technology. The following excerpt from Congressional Research Service report, *Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy,* describes the connection between the proposed EPA regulations from new power plants and development of CCS technology:[10]

> *"In 2012 the U.S. Environmental Protection Agency (EPA) proposed a new rule that would limit emissions of carbon dioxide (CO2) to no more than 1,000 pounds per megawatt-hour of production from new fossil-fuel power plants with a capacity of 25 megawatts or larger. EPA proposed the rule under Section 111 of the Clean Air Act. According to EPA, new natural gas-fired combined-cycle power plants should be able to meet the proposed standards without additional cost. However, new coal-fired plants would only be able to meet the standards by installing carbon capture and sequestration (CCS) technology. EPA missed its original deadline for issuing a final rule and has not indicated when it will publish the final rule.*
>
> *The proposed rule sparked increased scrutiny of the future of CCS as a viable technology for reducing CO2 emissions from coal-fired power plants. It also placed a new focus on whether the U.S. Department of Energy's (DOE's) CCS research, development, and demonstration (RD&D) program will achieve its vision of developing an advanced CCS technology portfolio ready by 2020 for large-scale CCS deployment.*
>
> *Congress appropriated $3.4 billion from the American Recovery and Reinvestment Act (Recovery Act) for CCS RD&D at DOE's Office of Fossil Energy in addition to annual appropriations for CCS. The large influx of funding for industrial-scale CCS projects may accelerate development and deployment of CCS in the United States. Since enactment of the Recovery Act, DOE has shifted its RD&D emphasis to the demonstration phase of carbon capture technology. However, the future deployment of CCS may take a different course if the major components of the DOE program follow a path similar to DOE's flagship CCS demonstration project, FutureGen, which has experienced delays and multiple changes of scope and design since its inception in 2003.*

---

[9] The White House, *"The President's Climate Action Plan,"* June 2013. Accessible at: http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

[10] Congressional Research Service, *"Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy,"* June 10, 2013. Accessible at: http://www.crs.gov/pages/Reports.aspx?PRODCODE=R42496

To date, there are no commercial ventures in the United States that capture, transport, and inject industrial-scale quantities of CO2 solely for the purposes of carbon sequestration. However, CCS RD&D has embarked on commercial-scale demonstration projects for CO2 capture, injection, and storage. The success of these projects will likely influence the future outlook for widespread deployment of CCS technologies as a strategy for preventing large quantities of CO2 from reaching the atmosphere while U.S. power plants continue to burn fossil fuels, mainly coal. Given the pending EPA rule, congressional interest in the future of coal as a domestic energy source appears directly linked to the future of CCS...

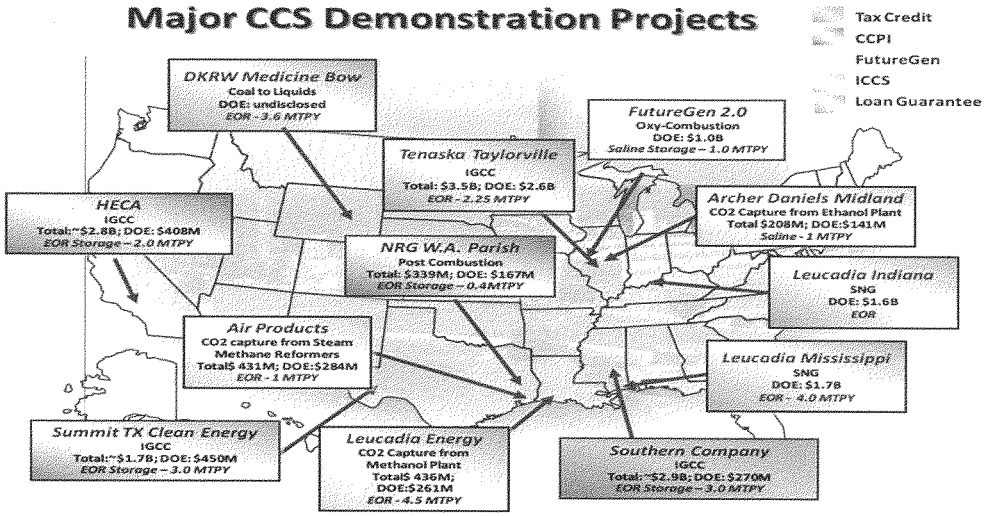
...Alternatively, congressional oversight of the CCS RD&D program could help inform decisions about the level of support for the program and help Congress gauge whether it is on track to meet its goals. A DOE Inspector General audit report identified several weaknesses in the DOE management of awards made under the Industrial Carbon Capture and Storage (ICCS) program funded by the Recovery Act. The audit report noted that addressing these management issues would be important to future management of the program, given that DOE had only obligated about $623 million of the $1.5 billion appropriated for the ICCS program under the Recovery Act as of February 2013."

ADDITIONAL READING

- Congressional Research Service, *Carbon Capture and Sequestration (CCS): A Primer*. July 16, 2013. http://www.crs.gov/pdfloader/R42532
- Coal Utilization Research Council: *The CURC-EPRI Coal Technology Roadmap*, August 2012. http://www.coal.org/userfiles/file/FINAL%20Roadmap%20Report%20Update%20-%20August%202012%20(graphics%20and%20links).pdf

Appendix A[11]

Attachment 2. Federally Supported CCS Demonstration Projects Currently Under Development



*Additional Advances Coal Demonstration Projects include Duke Edwardsport IGCC (no C02 capture component) and Tenaska Trailblazer Energy Center (no public funds received)

[11] CURC-EPRI Roadmap.

Chairman LUMMIS. Good morning. Welcome to today's hearing titled "The Future of Coal: Utilizing America's Abundant Energy Resources." And now the Subcommittee on Energy will come to order.

In front of you are packets containing the written testimony, biographies and Truth in Testimony disclosures of today's witness panel. I now recognize myself for a five minute opening statement and then I will turn it over to my Ranking Member, Mr. Swalwell. Thank you all for being here, and we will have others trickling in as the morning goes on.

Coal is of critical importance to the United States. From Thomas Edison's construction of the world's first electric power plant in 1892, through today, coal has led the way in enabling the enormous improvements to Americans' health and well-being. It remains our leading source of affordable and reliable electricity, providing a foundation for our national and economic security while directly supporting hundreds of thousands of jobs and powering industrial facilities that produce the inexpensive goods we too often take for granted so middle- and lower-income Americans can enjoy a higher standard of living and make their hard-earned dollars go farther.

Rarely, however, has such a beneficial, life-improving resource upon which society depends been under such hostile attack. Adding injury to insult, this attack is being led by our own President. In 2008, President Obama boasted on the campaign trail that his policies would necessarily bankrupt any company that wanted to build a coal-fired power plant.

Unfortunately, this is one campaign promise that the President appears determined to keep. Not only are his EPA power plant regulations effectively prohibiting new coal plants from being constructed, they are imposing massive costs on existing plants and forcing scores of shutdowns. For example, 288 coal units in 32 states cited current and pending EPA regulations as a factor contributing to their expected closure.

Senior members of the Obama Administration have readily acknowledged the negative impacts of these policies. For example, former DOE Deputy Assistant Secretary for Fossil Energy Jim Wood estimated that EPA rules could force up to—excuse me—that EPA rules could force up to 70 gigawatts of coal offline, adding: "Number one, electric rates are going to go up. Number two, whether or not construction jobs in the green industry are created, I think there are virtually no manufacturing jobs that are likely to be created from the replacement of coal. Three, transmission grid stability is likely to emerge as a major issue, both because of the shutdowns and because of the intermittency of renewables."

EPA is just one agency leading the war on coal. On Tuesday, the House Natural Resources Committee discussed the Department of Interior's anti-coal regulations that would restrict coalmining activities and result in thousands of lost jobs in the coalmining industry.

Incredibly, the President is even attempting to limit the global use of coal by restricting international aid for it in developing countries, thus limiting access to the primary means through which those countries' citizens escape poverty.

Even if the President were successful in his quest to eliminate all U.S. coal-fired power plants, any potential reductions in projected global warming would more than undertaken by global emission growth. China continues to build a coal plant a week, and global coal demand is projected to continue to grow significantly over the next half century, regardless of U.S. domestic policy.

The purpose of today's hearing, and the challenge before us in this Subcommittee, is to apply these regulatory, economic and global realities to improve the focus and prioritization of DOE's coal related activities. To this end, I look forward to hearing more about the recently developed coal R&D roadmap and how it could help identify technology opportunities to increase efficiencies, reduce pollutants, minimize water consumption, and lower the cost of electricity.

I am also eager to examine in more detail the truly innovative research underway at the Western Resources Institute in Wyoming. WRI serves as a model of how to bring together public, private and academic stakeholders to advance development and use of abundant and affordable energy supplies.

[The prepared statement of Mrs. Lummis follows:]

PREPARED STATEMENT OF SUBCOMMITTEE CHAIRMAN CYNTHIA LUMMIS

Good morning and welcome to this morning's hearing titled The Future of Coal: Utilizing America's Abundant Energy Resources.

Coal is of critical importance to the United States. Since the founding of our country, through Thomas Edison's construction of the world's first electric power plant in 1892, and continuing still today, coal has led the way in enabling the enormous improvements to Americans' health and well-being. It remains our leading source of affordable and reliable electricity, providing a foundation for our national and economic security while directly supporting hundreds of thousands of jobs and powering industrial facilities that produce the inexpensive goods we too often take for granted.

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Thank you, and I now yield to Ranking Member Swalwell for his opening statement.

Chairman LUMMIS. Thanks, and I now yield to Ranking Member Swalwell for his opening statement.

Mr. SWALWELL. Thank you, Chairman Lummis, and first, I ask unanimous consent that Ranking Member Johnson of the Full Committee, that her opening statement be entered into the record. She will not be able to be here today but has been a leader in this area, and I hope the Committee will accept that.

Chairman LUMMIS. Accepted.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
RANKING MEMBER EDDIE BERNICE JOHNSON

Thank you, Chairman Lummis for holding this hearing today. I would also like to thank all the witnesses for coming in to discuss the future role of coal in the United States.

I am pleased, in particular, to welcome Ms. Judi Greenwald, who will be able to tell us more about some important projects in the great State of Texas—where we have seen the value of coal energy, but also its negative impacts.

Coal has been an abundant and important source of energy through much of our Nation's history, and that is why I support the Department of Energy's efforts to make our use of coal cleaner and more efficient even as we lay the foundation for a more sustainable energy future.

I am not here to promote one industry over another. Instead, I believe we must promote policies that protect our environment, meet our energy needs, and keep Americans working.

We must do more than just keep the lights on. We need to work towards an energy future that recognizes that our environment is changing, in part due to our past energy usage.

Record droughts and severe storms are sadly becoming too common, but I and many of my colleagues here today stand determined to do everything we can to curb the man-made causes of climate change and give our future generations a sense of environmental security while still providing them with a strong economy.

So I look forward to hearing from our witnesses today on what we are doing, and what still needs to be done, to ensure that our mature coal industry follows the lead of our vibrant renewable energy sector in developing the environmentally responsible energy sources of today, and tomorrow.

Mr. SWALWELL. Thank you, I also wanted to thank you for holding this hearing, and I want to thank the witnesses for their testimony today, and I am pleased also to welcome Ms. Judi Greenwald from the Center for Climate and Energy Solutions, a group that does a lot of work in Texas, the home state of our Full Committee Chairman Mr. Smith, our Ranking Member, Ms. Johnson, and my colleague on this Subcommittee, Mr. Veasey, and Mr. Veasey will introduce Ms. Greenwald in a moment.

This morning before I came over here, I had some students in my office, just part of a constituent thing that we do about a couple times a month, and they asked where I was going and I told them I was going to this hearing on coal, and these are students from my district. They kind of had this puzzling look on their face, and I said yes, that is right, coal. You know, I know you are from California, we don't necessarily rely upon coal as our energy resource but the rest of the country and many places does, and I explained to them that we are at this point right now in our country where we are in a struggle and a pull, and we are trying to figure out where are we going to provide, how are we going to provide the future of our energy needs, and in California, we are proud that 20 percent of our electricity in 2009, the last study that was available, was provided by renewables. And so California has always seen ourselves as kind of leading the country forward and moving away from dirty fossil fuels that could hurt the environment and not be so good for our children or the future. But coal does have a place to play, and I am interested and have always agreed that the all-of-the-above approach is the way we should go, and wherever we can make it safe, we should make it happen, and I support the chair's interest in doing this.

But I say that what the President talked about a couple weeks back with climate change was not a war on coal. In fact, I saw it as the opposite. I saw it as a retreat from coal, not a war on coal but an attempt for the United States to eventually one day hopefully pull out of coal and pull closer to more renewable, cleaner energy sources, and that is what I support. But until that day comes, I will continue to work with our chair to find a future of coal that is clean and good for our environment, and we should not ignore the possibilities available today as we continue to move and strive for the fuels of tomorrow. And programs like the National Enhanced Oil Recovery Initiative demonstrate their innovative capabilities of a mature coal industry that has long enjoyed Federal support. Carbon capture and storage and enhanced oil recovery are examples of important technologies that will help ensure that our present reliance on coal will not hinder our ability to move towards a cleaner, safer environment. These advances also support Americans working in these industries today, even as we lay the foundation for emerging energy technologies that will support the workforce of the future.

So I look forward to working with you, Chair, on doing this, hearing from our witnesses and making progress in this area, and with that, I yield back the balance of my time.

[The prepared statement of Mr. Swalwell follows:]

PREPARED STATEMENT OF SUBCOMMITTEE RANKING MEMBER ERIC SWALWELL

Thank you, Chairman Lummis, for holding this hearing. I want to also thank the witnesses for their testimony and for being here to answer our questions today. I am pleased to welcome Ms. Judi Greenwald, from the Center for Climate and Energy Solutions, a group that does a lot of work in Texas, the home state of our Full Committee Chairman Mr. Smith, our Ranking Member Ms. Johnson, and my colleague on this Subcommittee, Mr. Veasey.

This hearing is an opportunity to demonstrate the value of a true "all-of-the-above" approach to energy production, which has to include taking the necessary steps to make existing fuel technologies cleaner and more efficient. I am a strong supporter of the policies that have helped my state of California see growth in the

solar and wind energy sectors, which provide clean energy to millions while meeting the job demands of a growing workforce. However, we should not ignore the possibilities available today as we move towards the fuels of tomorrow.

Programs like the National Enhanced Oil Recovery Initiative demonstrate the innovative capabilities of a mature coal industry that has long enjoyed federal support. Carbon capture and storage and enhanced oil recovery are examples of important technologies that will help ensure that our present reliance on coal will not hinder our ability to move towards a cleaner, safer environment. These advances also support Americans working in these industries today, even as we lay the foundation for emerging energy technologies that will support the workforce of the future.

I look forward to learning more from our witnesses about progress being made in this area, and with that, I yield back the balance of my time.

Chairman LUMMIS. Thank you, Mr. Swalwell.

We have not seen the chairman of the Full Committee, Mr. Smith, come in. We have accepted the statement of the Ranking Member of the Full Committee. If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point. Thank you. We will begin then.

I would like to introduce our witnesses, and I will defer to Mr. Veasey when he arrives—excellent. Your opportunity to introduce Ms. Greenwald will be occurring shortly.

Our first witness toady is Chris Smith, Acting Assistant Secretary for Fossil Energy at the Department of Energy. Mr. Smith was appointed in 2009 as Assistant Secretary for Fossil Energy's Office of Oil and Natural Gas. Prior to joining DOE, Mr. Smith spent 11 years with international oil companies focused on upstream business development and LNG trading.

Our second witness is Ben Yamagata. Did I get that right, Mr. Yamagata?

Mr. YAMAGATA. Yes, Madam Chair.

Chairman LUMMIS. Thank you. Executive Director at the Coal Utilization Research Council. Mr. Yamagata is also a partner at Van Ness Feldman, where his practice encompasses energy, environment and natural resources. He has also served as Counsel and Staff Director for the Senate Energy and Natural Resources Subcommittee on Energy Research and Development.

Our third witness is Don Collins, Chief Executive Officer at the Western Research Institute. Mr. Collins focuses on transitioning scientific and applied research into technologies. He has spent 29 years of experience in engineering, management of research and deploying of new technologies.

And for today's final witness, Judi Greenwald, I yield to the gentleman from Texas, Mr. Veasey.

Mr. VEASEY. Thank you, Madam Chair, and before I introduce Ms. Greenwald, I would be remiss if I did not mention that Mr. Smith is from Fort Worth, my hometown in Texas, just outside of Dallas, and I am happy to have him on the panel today, and I wanted to introduce Judi Greenwald. Judi is the Vice President for Technology and Innovation at the Center for Climate and Energy Solutions. She oversees very many important aspects of that organization including the analysis and promotion of innovation in the major sectors that contribute to climate change including transportation, electric power, buildings and industry. In addition to her 30 years of working on environmental and energy policy, she also has a strong Texas connection and has worked with many organiza-

tions and individuals in our great state, and I want to welcome her here this morning.

Thank you, Madam Chair.

Chairman LUMMIS. Thank you, Mr. Veasey.

And now we will go to our witnesses. As you may know, spoken testimony is limited to five minutes each after which the Members of the Committee will have five minutes each to ask questions.

We welcome you here today, Mr. Smith. You are recognized first to present your testimony. My favorite boot store in all of America is in Fort Worth, and we are delighted to have a good Fort Worth native amongst us. So Mr. Smith, you are now recognized for five minutes.

TESTIMONY OF MR. CHRIS SMITH,
ACTING ASSISTANT SECRETARY
FOR FOSSIL ENERGY, DEPARTMENT OF ENERGY

Mr. SMITH. Well, thank you, Chairwoman Lummis. Lots of Fort Worth references this morning, so I am happy with that.

So thank you, Chairwoman, and thank you, Ranking Member Swalwell and Members of the Subcommittee, and I appreciate this opportunity to discuss Department of Energy's coal research and development activities.

Recently, our Secretary, Secretary Ernie Moniz, announced an $8 billion draft loan guarantee solicitation to promote the early development and deployment of innovative fossil energy projects that reduce carbon emissions. This solicitation in addition to the $6 billion the Obama Administration has already committed to clean coal technologies reflects the President's commitment to an all-of-the-above strategy that embraces an energy mix of nuclear power, renewable energy sources and fossil fuel, including clean coal.

The Department of Energy continues to play a leadership role in the development of clean coal technologies with a focus on carbon capture and storage, or CCS. The Clean Coal Research program, in partnership with the private sector, is focused on maximizing efficiency and environmental performance while minimizing the costs of these new technologies. In recent years, the program has been restructured to focus on clean coal technologies with carbon capture and sequestration. The program pursues the following two major strategies: first, capturing and storing greenhouse gases, and second, improving the efficiency of fossil energy systems.

The Clean Coal Research program is addressing the key challenges that confront the development and deployment of clean coal technologies through research on cost-effective capture technologies, monitoring, verification and accounting technologies to ensure permanent storage and the development of advanced energy systems. To get there, we are pursuing these three technical pathways for carbon capture: post-combustion, pre-combustion and oxy-combustion. Research in these pathways is exploring a wide range of approaches that, coupled with advances in efficiency improvements and cost reductions from developments in gasification turbines, will help provide a technology base for the commercial deployment of CCS technologies.

On the storage side, we have pursued projects to develop and design innovative advanced technology and protocols for the moni-

toring, verification, and accounting of CO_2 storage in geologic formations as well as simulating the behavior of geologically stored CO_2. Our original carbon sequestration partnerships are an essential component of that effort. The program is currently in the development phase during which large-scale field testing involving at least 1 million metric tons of CO_2 per project will be implemented. Several of these large-scale tests are currently underway, and one project has safely injected over 3.6 million metric tons and is being monitored for safe and permanent storage.

The Department is implementing large-scale projects for their regional partnerships, the Clean Coal Power Initiative, FutureGen 2.0, and the Industrial Carbon Capture and Storage program. We currently have eight major CCS demonstration projects nationwide, and there have been important advances in several of them. For example, the Archer Daniels Midland ICCS project in Illinois will demonstrate an integrated system of CCS in an ethanol production plant. The project is under construction and is nearly 50 percent complete. FutureGen 2.0 has successfully completed phase I, and phase II commenced in February of this year. The project is now focused on the preliminary design and engineering.

Current demonstrations are focused on storing CO_2 in a variety of geologic formations including enhanced oil recovery. Enhanced oil recovery represents the most commercially attractive utilization option for CO_2 storage that could produce substantial quantities of oil while permanently storing CO_2 in geologic formations. There are currently six projects employing CO_2 EOR and two projects employing saline storage underway across the United States. And as with saline storage projects, CO_2 EOR projects will be subject to rigorous monitoring, verification, accounting procedures, and technologies to ensure their safety and effectiveness.

Today, nearly three out of four coal-burning power plants in this country are equipped with technologies that can trace their roots back to the Department of Energy's advanced coal technology program. The Office of Fossil Energy's ongoing mission is to ensure that this important resource can be developed and utilized in an environmentally sensible way to strengthen our Nation's energy security, and I believe that our Clean Coal Research program demonstrates that we have the critical experience, expertise and capabilities, and the track record to meet this challenge.

Madam Chairwoman and Members of the Committee, that completes my prepared statement, and I would be happy to answer any questions that you may have.

[The prepared statement of Mr. Smith follows:]

Statement of Christopher Smith
Assistant Secretary for Fossil Energy (Acting)
U.S. Department of Energy

Before the
Committee on Science, Space and Technology
Subcommittee on Energy

U.S. House of Representatives

Coal Research and Development

July 25, 2013

Thank you Chairman Lummis, Ranking Member Swalwell, and members of the Subcommittee. I appreciate the opportunity to discuss the Department of Energy's (DOE) coal research and development (R&D) activities.

Coal fuels approximately 40 percent of our domestic electricity production. As the Energy Information Administration (EIA) recently pointed out in the Annual Energy Outlook 2013 reference case, coal is projected to remain the largest energy source for electricity generation through 2040.[1] Because it is abundant, the clean and efficient use of coal is a key part of President Obama's all-of-the-above energy strategy.

A major challenge to coal, however, is that it is a major source of carbon dioxide (CO_2) emissions. Therefore, it is critical that we promote currently available technologies and develop more economic and broadly available technologies to reduce those emissions from coal-fired power plants. To that end, the Obama Administration strongly supports the development of clean coal technologies, including carbon capture and storage (CCS). In addition to the Administration's annual budget requests, that support was made clear in the 2009 American

[1] "Annual Energy Outlook 2013," Energy Information Administration.

Recovery and Reinvestment Act (Recovery Act), which provided $3.4 billion for CCS. It was also evident in the formation of the Interagency Task Force on Carbon Capture and Storage, which the President charged in February 2010 to develop a plan to overcome the barriers to the widespread, cost-effective deployment of CCS within 10 years.

On June 25, President Obama laid out a broad Climate Action Plan to cut carbon pollution in America, prepare the United States for the impacts of climate change, and lead international efforts to combat global climate change and prepare for its impacts. A key component of that plan is an $8 billion draft loan guarantee solicitation which is designed to support investments in innovative technologies that can cost-effectively meet financial and policy goals, including the avoidance, reduction, or sequestration of anthropogenic emissions of greenhouse gases. The proposed solicitation will cover a broad range of advanced fossil energy projects. The draft solicitation was released on July 2, commencing a 60 day public comment period.

As the President has made clear, fossil fuels – including coal – provide more than 80 percent of our energy today and they are projected to remain a large source of energy for decades. The fossil solicitation – in addition to the $6 billion the Administration has already committed to clean coal technologies - reflects the Administration's commitment to "all of above" energy strategy that develops every available source of American energy -- a strategy that's cleaner, cheaper, and full of new jobs.

Clean Coal Research Program

DOE continues to play a leadership role in the development of clean coal technologies with a focus on CCS. The Clean Coal Research Program – administered by DOE's Office of Fossil Energy and implemented by the National Energy Technology Laboratory – is designed to enhance our energy

security and reduce environmental concerns over the future use of coal by developing a portfolio of revolutionary clean coal technologies. The Program is well positioned to help overcome the technical challenges associated with the development of clean coal technologies.

The Clean Coal Research Program, in partnership with the private sector, is focused on maximizing efficiency and environmental performance, while minimizing the costs of these new technologies. In recent years, the Program has been restructured to focus on clean coal technologies with CCS. The Program pursues the following two major strategies:

1) capturing and storing greenhouse gases; and

2) improving the efficiency of fossil energy systems.

The first strategy aims to remove emissions of greenhouse gases from fossil fueled energy systems. The second strategy seeks to improve the fuel-to-energy efficiencies of these systems, thus reducing pollutant emissions, water usage, and carbon emissions on a per unit of energy basis. Collectively, these two strategies comprise the Clean Coal Research Program's approach to ensure that current and future fossil energy plants can contribute to a safe and secure clean energy future.

Core Research and Development Activities

The Clean Coal Research Program is addressing the key challenges that confront the development and deployment of clean coal technologies through research on cost-effective capture technologies; monitoring, verification, and accounting technologies to ensure permanent storage; and development of advanced energy systems. As an example, today's commercially available CO_2 capture technologies are projected, after experience gained from multiple plant installations, to increase the cost of electricity by as much as 70 percent for a new coal-fueled power plant

(equivalent to about $60 per tonne of CO_2 captured) This cost is for removing 90 percent of the CO2 emissions and exclusive of any expenses associated with transporting and storing the captured CO_2, but it also omits potentially material benefits from using the CO2 for enhanced oil recovery, as discussed in detail below[2,3] Recognize that capturing less than 90 percent CO2 emissions from either a new or existing power plant will reduce the cost of electricity penalty, as expected. However, installing a smaller unit to remove less CO2 emissions will result in an increase in avoided CO2 mitigation costs due to the loss of "economies of scale" savings associated with the larger capital equipment. The Program is aggressively pursuing developments that would reduce the cost penalty for electricity from new coal-fueled power plants with carbon capture from roughly 70 percent to about 35 percent (equivalent to about $40 per tonne of CO_2 captured).

Research is focused on developing technology options that dramatically lower the cost of capturing carbon dioxide from fossil fueled energy plants. This research can be categorized into three technical pathways: post-combustion, pre-combustion, and oxy- combustion. Post-combustion refers to capturing CO_2 from the stack gas after a fuel has been combusted in air. Pre-combustion refers to a process where a hydrocarbon fuel is gasified to form a mixture of hydrogen and carbon dioxide, and CO_2 is captured from the synthesis gas before it is combusted. Oxy-combustion is an approach where a hydrocarbon fuel is combusted in pure or nearly pure oxygen rather than air, which releases energy and produces a mixture of CO_2 and water that can easily be separated to produce pure CO_2.

Collectively, research in each of these technical pathways is exploring a wide range of approaches such as membranes; oxy-combustion concepts; solid sorbents; advanced gas/liquid scrubbing

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technologies; and advanced hybrid concepts such as liquid membrane contactors.

These efforts cover not only improvements to state-of-the-art technologies but also development of several revolutionary concepts, such as metal organic frameworks, ionic liquids, enzyme-based systems, and chemical looping – a form of oxy-combustion that utilizes oxygen from metal oxide oxygen carrier for fuel combustion, or for making hydrogen by "reducing" water. In combustion applications, the products of chemical looping are CO_2 and H_2O. Thus, once the steam is condensed, a relatively pure stream of CO_2 is produced ready for sequestration.

Coupling these developments with other advances in efficiency improvements and cost reduction from developments in gasification and turbines, will help provide a technology base that overcomes economic barriers to commercial adoption of fossil energy systems integrated with CCS.

Regional Carbon Sequestration Partnerships

The Regional Carbon Sequestration Partnerships were created by DOE in 2003 through a competitive solicitation. The Partnerships were designed to address a range of issues associated with geologic storage of CO_2. The Clean Coal Research Program has been performing CCS field tests focused on injection, monitoring, verification, accounting and other aspects of geologic storage for many years, and the seven Regional Carbon Sequestration Partnerships are critical to this effort. These Partnerships are comprised of state agencies, universities, and private companies. They represent more than 400 unique organizations in 43 States, and four Canadian Provinces. Geographic differences in fossil fuel use and potential storage sites across the United States dictate the use of regional approaches in addressing CCS, so each Partnership is focused on a specific region of the United States and Canada that holds similar characteristics relating to CCS opportunities.

Together, the Partnerships form a network of capability, knowledge, and infrastructure that will help enable geologic storage technology to play a role in the clean energy economy. They represent regions encompassing 97 percent of coal-fired CO_2 emissions, 97 percent of industrial CO_2 emissions, 96 percent of the total land mass, and essentially all the geologic storage sites that can potentially be available for geologic carbon storage.

During the Validation Phase of the program, Regional Partnerships drilled wells and injected small quantities of CO_2 to validate the potential of key storage locations totaling more than 1 million metric tons of CO_2 at 18 small scale injection projects throughout the United States and Canada. Those tests helped to validate storage at a small scale to understand the fate of CO_2 in different depositional systems containing saline water, oil, and natural gas. The program is currently in the Development Phase, during which large-scale field testing involving at least 1 million metric tons of CO_2 per project will be injected. Tests are designed to not only investigate commercial-scale injection of CO_2, but will also be used to understand the necessary regulatory, economic, liability, ownership, and public outreach efforts needed for successful CCS, and to develop the necessary human capital, knowledge base, and experience necessary to implement future CCS operations. Several of the large-scale tests are currently underway and one project has safely injected over 3.6 million metric tons and is being monitored for safe and permanent storage.

Over the course of these initiatives, DOE and the Partnerships are addressing key infrastructure issues related to permitting, pore space ownership, site access, liability, public outreach, and education. We are also jointly developing Best Practice Manuals on topics such as site characterization, site construction, operations, monitoring, mitigation, closure, and long-term stewardship. These Manuals will serve as guidelines for a future geologic sequestration industry in their regions, and help transfer the lessons learned from DOE's Clean Coal Research Program to

all regional stakeholders. The first editions of the Best Practice Manuals are available on DOE's reference shelf [4] and the Manuals will be periodically updated as lessons learned from the large scale field tests are realized.

We have also pursued projects designed to develop technologies and protocols for the monitoring, verification, accounting, and assessment (MVAA) of CO_2 storage in geologic formations as well as simulating the behavior of geologically-stored CO_2. MVAA of geologic storage sites is an important part of making geologic storage a safe, effective and reliable method of greenhouse gas control. These activities will culminate in a set of best practices for the deployment of carbon capture, utilization and storage technology.

Finally, DOE and the Partnerships continue to work closely with the Environmental Protection Agency (EPA) and other Federal and state agencies in developing CCS regulatory strategies, which will provide additional certainty for future CCS deployments.

Demonstrations at Commercial-Scale

The success of the Clean Coal Program will ultimately be judged by the extent to which emerging technologies get deployed in domestic and international marketplaces. Both technical and economic challenges associated with the deployment of newer coal technologies must be overcome in order to be capable of achieving success in the marketplace. Commercial-scale demonstrations help the industry understand and overcome start-up issues, address component integration issues, and gain the early learning commercial experience necessary to reduce technology risk and secure private financing and investment for future plants.

The Department is implementing commercial-scale demonstration projects through the Clean

[4] http://www.netl.doe.gov/technologies/carbon_seq/refshelf/refshelf.html

Coal Power Initiative (CCPI), FutureGen 2.0, and the Industrial Carbon Capture and Storage (ICCS) program.

The CCPI is a cost-shared partnership between the Government and industry to develop and demonstrate advanced coal-based power generation technologies at the commercial scale. By enabling advanced technologies to overcome technical risks involved with scale-up and bringing them to the point of commercial readiness, CCPI accelerates the development of advanced coal generation technologies integrated with CCS. The CCPI also facilitates the movement of technologies into the marketplace that are emerging from the core research and development activities.

The CCPI program received an additional $800 million from the Recovery Act which, in combination with base funding, was used to fund four CCPI Round III projects, of which two pre-combustion and one post-combustion capture projects are still active. In addition, a CCPI Round II project, with Southern Company Services, was modified to demonstrate CCS at a new integrated gasification combined cycle power plant. Having completed all design, planning, and environmental review requirements, this project began construction in 2010 and project construction is now 63 percent complete.

The FutureGen 2.0 Project intends to conduct novel large-scale testing to accelerate the deployment of advanced oxy-combustion power production technologies integrated with CCS. This project will be the first advanced repowering oxy-combustion project to store CO_2 in a deep saline geologic formation. On August 5, 2010, then-Secretary of Energy Steven Chu announced an award totaling $1 billion in Recovery Act funding to 1) The FutureGen Alliance and 2) Ameren Energy Resources along with their partners (Babcock & Wilcox and Air Liquide Process and Construction, Inc.) to repower an existing plant with advanced oxy-combustion technologies.

Together, these two awards comprised the FutureGen 2.0 project for clean coal repowering with CCS. On February 28, 2011, the FutureGen Alliance selected Morgan County, Illinois, as the preferred location for the FutureGen 2.0 CO_2 storage site, visitor center, and research and training facilities. The Alliance has subsequently taken over leadership of both projects comprising the FutureGen 2.0 program.

FutureGen 2.0 has successfully completed Phase I, which included identification of a sequestration site, preliminary characterization and test drilling, and a commitment from the Illinois Commerce Commission to cover the project's output under its purchasing plans. Phase II commenced on February 1, 2013, and the project is now focused on preliminary design and engineering.

In addition to the CCPI and FutureGen 2.0 projects, the Recovery Act has also helped fund more than 80 additional projects, which includes three large scale ICCS demonstrations, 10 geologic site characterizations, 43 university research training projects, seven CCS research training centers, six ICCS projects focused on CO_2 reuse, and 14 projects focused on accelerated component development in the core research program.[5]

Examples of progress on these projects include the Archer Daniels Midland ICCS project in Illinois, which will demonstrate an integrated system of CO_2 capture in an ethanol production plant and geologic sequestration in a sandstone reservoir. This project is under construction and approximately 49 percent complete. In Texas, the Air Products and Chemicals, Inc. ICCS project recently began capturing CO_2 from two steam methane reformer hydrogen production plants for enhanced oil recovery (EOR) operations. This project is the first to capture CO_2 at large scale from steam methane reformers used for hydrogen production, with the captured CO_2 then utilized for EOR.

[5] Details about all of the Fossil Energy projects funded by the Recovery Act can be found here: http://energy.gov/fe/fe-implementation-recovery-act.

CO_2 Utilization Technologies

The coal research and development program has supported research on CO_2 utilization technologies for more than a decade. When the Carbon Storage Program (formerly named the Sequestration Program) was initiated in the mid-1990s, it was recognized that technologies such as mineralization, chemical conversion to useful products, algae production, enhanced oil recovery and enhanced coal bed methane recovery could play an important role in mitigating CO_2 emissions. Other than EOR, the CO_2 emissions reduction potential of these approaches is limited, due to factors such as cost and market saturation of salable byproducts. Even so, these approaches are logical "first-market entry" candidates for greenhouse gas mitigation, due to their ability to produce revenue from use of the CO_2 that could be used to offset the costs for these "early adopters." Hence, these options provide a technology bridge and smoother transition to the deployment of the large-scale, stand-alone geologic sequestration operations that will ultimately be needed to achieve the much larger emissions reductions required to approach stabilizing greenhouse gas concentrations in the atmosphere.

EOR represents the most near term and most commercially attractive utilization option for captured CO_2. Over the history of the Department, the focus of CO_2-EOR R&D has shifted from increased incremental oil production to monitoring, verification, and accounting of geologically stored CO_2 as part of a climate change mitigation strategy. As early as the 1970s, DOE-funded projects were developing concepts to improve the effectiveness and applicability of CO_2-EOR. Currently, most commercial EOR projects have been strategically located near cheap sources of naturally occurring CO_2 or along pipelines from such sources. If research into reducing the cost of CO_2 capture from power plants proves successful, anthropogenic sources of CO_2 may become readily available for EOR projects. The DOE's 2012 Carbon Utilization and Storage Atlas of the United States projects

a potential CO_2 storage resource estimate of over 200 billion tonnes for oil and gas reservoirs in the United States. In the near-term, incremental oil produced via EOR using anthropogenic CO_2 could help offset the costs of CO_2 capture. The prospect of relatively low-cost supplies of captured CO_2 in widespread areas of the country could, in turn, provide the impetus for a national re-evaluation of the EOR potential in many mature fields. While conventional EOR is a widely used process, CO_2 capture and permanent storage is not yet widely used at power plants. Continued evolution of EOR and transformational advances in development and deployment of CO_2 capture from coal power on a large scale could help realize the synergy between the coal/power industry and the oil industry. Utilization of the CO_2 in EOR will impart knowledge that will be instrumental in the Department's continued focus on R&D in other geologic storage formations such as saline that have a larger storage potential for CO_2.

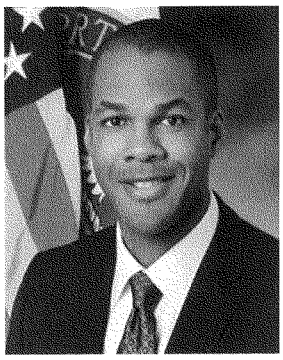
Conclusion

Today, nearly three out of every four coal-burning power plants in this country are equipped with technologies that can trace their roots back to DOE's advanced coal technology program. These efforts helped accelerate production of cost-effective compliance options to address legacy environmental issues associated with coal use. CCS and related clean coal technologies can play a critical role in mitigating CO_2 emissions under many potential future carbon stabilization scenarios. CO_2 utilization technologies with salable byproducts are logical "first market entry" candidates for greenhouse gas mitigation due to their ability to produce revenue from the use of CO_2. EOR will be the dominant utilization opportunity in the near term and will impart additional experience that will be useful in the Department's continued focus on R&D in other storage formations, such as deep saline aquifers, necessary to address climate change. Nevertheless, challenges remain to promote currently available technologies and develop more economic and

broadly available technologies for deployment of CCS. The Department's research programs and efforts have spearheaded R&D that would not have occurred otherwise and has successfully leveraged private investment in advancing the readiness of these emerging clean coal technologies.

Mr. Chairman, and members of the Committee, this completes my prepared statement. I would be happy to answer any questions you may have at this time.

Christopher Smith
Assistant Secretary for Fossil Energy (Acting)
Principal Deputy Assistant Secretary
U.S. Department of Energy



Christopher Smith is Principal Deputy Assistant Secretary and Acting Assistant Secretary for Fossil Energy with responsibilities for office operations and managing the oversight of Fossil Energy's Research and Development program (encompassing coal, oil and natural gas) and the U.S. Petroleum Reserves.

He was appointed to the Department of Energy in 2009 as Deputy Assistant Secretary for FE's Office of Oil and Natural Gas.

Prior to joining DOE, Smith spent eleven years with two major international oil companies focused primarily on upstream business development and LNG trading, including three years negotiating production and transportation agreements in Bogotá, Colombia.

Smith began his career as an officer in the U. S. Army and served tours in Korea and Hawaii. Smith holds a bachelor's degree in Engineering Management from the United States Military Academy at West Point and an MBA from Cambridge University.

Chairman LUMMIS. Thank you very much, Mr. Smith.
I now recognize Mr. Yamagata to present his testimony.

**TESTIMONY OF MR. BEN YAMAGATA,
EXECUTIVE DIRECTOR,
COAL UTILIZATION RESEARCH COUNCIL**

Mr. YAMAGATA. Madam Chair, Ranking Member Swalwell, Members of the Subcommittee, thank you for giving me the opportunity to make these comments today. I will specifically focus my comments on the two subject areas you asked me to address by discussing four points.First, in describing to you, as you requested, our coal technology development roadmap done in conjunction with the Electric Power Research Institute, let me say we concluded that we can develop technologies that will achieve very high conversion efficiencies moving electricity generation from today's high of 39 or 40 percent to nearly 50 percent. Following the same roadmap agenda will result in significant reductions in traditional air pollutants, leading ultimately to coal-fueled plants that really today are very clean but will be nearly emissions-free in the future. Since the 1970s, the DOE's coal R&D program and the work of the National Energy Technology Lab in collaboration with industry has, as the Assistant Secretary pointed out, now been installed on many of the coal units in this country. With DOE's support, we are confident that technology will be the pathway to also addressing CO_2 emissions from the use of coal.

Second, you have asked if our roadmap might be a way of examining the prioritization of DOE's R&D activities. Let me start by stating our general agreement with DOE's R&D portfolio and note industry's successful collaboration with the Fossil Energy Office. Where we see need for added emphasis, CCS should not be the singular focus of the government's R&D supported efforts. We recommend an emphasis also on technology development to address water use and discharge from power plants and increased support for high-temperature-materials development. These advanced materials are key to increasing the efficiency of coal conversion to electricity. DOE may need to focus more attention now on technologies that are truly transformational, and that move beyond simply adding a series of improved control technologies to power plant platforms that generate electricity from power-generating technology now itself several decades old. And finally, an inquiry should be made whether the pace of technology development pursued by DOE fits the age profile of the country's existing coal fleet. We might require commercially available technology for retrofit of coal units or the replacement of coal units by the early 2020s so that technology can be used in the later 2020s or 2030s. DOE's technology timelines could be too late by several years. Also, the President's Fiscal Year 2014 coal R&D budget request is nearly $100 million less than what we believe is required.

Third, the added cost of new and pending environmental regulations, uncertainty over future regulations and market competition from abundant natural gas have led to projections that perhaps 60 to 80 gigawatts of older coal plants—that is 20 to 25 percent of the existing fleet—will be retired in the next several years. Anticipated CO_2 requirements could dramatically increase the number of those

requirements. CURC has commented that the original EPA CO_2 proposal for new coal plants requiring those plants to meet a defined CO_2 standard that can only be met with the installation of carbon capture technology that is not commercially available nor economic today, this is not a realistic standard. We will await the re-proposal of this rule, but if it is still predicated upon technology that is not commercially available, our concerns remain. Simply directing or assuming the existence of technology will not make it so.

And point four, you asked that we comment upon research activities that should be pursued in the near, mid and long term. CURC is developing a three-part program that is organized around the proposition that technology development is a positive pathway to the sustained and increased use of coal but our program is being developed through the prism of defining benefits to the Nation from coal use. In the near term, we are considering recommendations to undertake the technology R&D to address challenges to the existing baseload fleet, which is now a cycling fleet, while simultaneously confronting ever-more stringent air regulations. In the medium term, we need to ensure that the DOE demonstrations currently underway are successful. An additional demonstration program is needed to encourage the construction of world-class, coal-fueled generation plants meeting very high efficiency and emission control standards and committing those projects to retrofit with carbon capture technology when that technology is commercially available. Also, we would recommend a program to use captured CO_2 from coal-using facilities for enhanced oil recovery. We are looking for ways to accomplish our mid-term program without new government spending. Progress is being made on this front. And finally, in the long term, government in partnership with industry needs to pursue a targeted R&D program.

Thank you for your time, and I will await your questions.

[The prepared statement of Mr. Yamagata follows:]

Statement of the Coal Utilization Research Council (CURC)

Submitted to the Subcommittee on Energy

Committee on Science, Space and Technology

Hearing on

"The Future of Coal: Utilizing America's Abundant Energy Resources"

Thursday, July 25, 2013

A.1. Introduction and Summary of the CURC written statement

This statement, submitted on behalf of the Coal Utilization Research Council (CURC), addresses the findings and recommendations of the CURC-EPRI Roadmap, as well as research activities and policy considerations that will be critical to ensuring continued affordability and reliability of coal in the near, mid, and long-term.

To respond to the questions posed by the Committee this statement addresses the following:

1. **Coal is a vital domestic resource that provides low-cost and reliable electricity** - Our vast, domestically secure supply of coal has fueled the American economic machine for hundreds of years and our fleet of existing coal-fired power plants provides very inexpensive electricity. This means that U.S. industry has a competitive edge over manufacturers in other countries that do not have reliable, abundant, low-cost electricity generated from coal resources, and consumers are able to keep more of their income to spend on other expenses.

   Furthermore, as of 2012, coal continued to provide 37% of the electricity generated and consumed in this country. The Energy Information Administration (EIA) projects in its latest Annual Energy Outlook, (2013) that coal will continue to provide approximately 40% of our electricity needs through 2040 (the end of the EIA projection period). Given that the nation will continue to rely on coal, it is imperative that technologies be developed that allow for coal to be used in an increasing clean and economic manner.

   Finally, it is important to remember that diminishing or extinguishing the use of in the United States, a totally unrealistic scenario, will not address global emissions of CO_2 given the enormous growth of coal worldwide. Technology to control or prevent such emissions is the answer.

2. **But the Coal Industry Faces Several Challenges** - Coal's challenges are associated primarily with the cost of complying with an array of recent and pending Environmental Protection Agency (EPA) environmental requirements as well as competition from low cost natural gas. While existing coal-fired power plants are highly competitive with other sources of electricity, the added cost of recently adopted environmental regulations (new-source

PSD/BACT permitting), uncertainty over future regulations (recently promulgated CO_2 emissions standards for new and existing plants under Section 111 of the Clean Air Act), and other factors have led to projections that approximately 60-80 GW of older coal-fired units (20-25% of the current 310 GW coal fleet) will retire over the next several years. Furthermore, EIA projects that once 6 gigawatts of coal units now under construction commence operation (by 2015), there will be essentially no additional coal units built until after 2035, and only 1.5 gigawatts by 2040.

3. **Technology has solved coal's economic and environmental challenges in the past, and technology development and application can again solve these concerns** -- CURC's members believe that the development and application of technology to the current and future fleet of coal-fired power plants will enable our nation's coal resources to continue to contribute to the nation's generation mix while simultaneously addressing environmental and economic concerns. The proven formula for success in addressing environmental and economic concerns has been the collaborative, cost-sharing efforts of the government through the Department of Energy's Coal R&D Program and the private sector. Today, three out of every four coal plants in the U.S. are equipped with technologies that trace their origins to DOE's coal R&D program. The successful development and use of technologies have allowed coal use to increase by more than 180% since the early 1970s while the emissions rates of SO_2 and NOx have decreased by approximately 85%. In addition to developing commercial technologies to control criteria pollutants for NOx, SO2, particulate matter and mercury, the government and industry partnership is responsible for the commercial deployment of pressurized fluidized bed combustion systems, new coal-based IGCC systems, advanced turbines, and development of materials for highly efficient advanced coal combustion power plants.

   The key to ensure continued success is (1) adequate public support, (2) enhanced levels of funding targeted to specific technology areas, and (3) a regulatory and public policy framework that supports coal use.

4. **The CURC-EPRI Technology Roadmap Defines Technology Development Needs and Timelines** - CURC, together with the Electric Power Research Institute (EPRI), has developed a Technology Roadmap (Roadmap) that defines the research, development and demonstration necessary to ensure that the benefits of coal utilization in the U.S. continue into the future. The Roadmap represents a plan for developing technologies that convert coal to electricity and other useful forms of energy as well as into manufacturing feedstocks. Our Roadmap and accompanying analysis concluded that several coal technology advancements, if developed, will achieve specific cost, performance and

environmental goals thereby benefiting the nation's environment, economy, and energy security.

Importantly, the Roadmap strongly recommends that the Department of Energy continue supporting the current suite of select CCS demonstration projects and, in the future, make authorizations to encourage additional demonstrations and deployment of "second generation" and transformational coal technologies.

5. **Funding requests by the Administration must be significantly increased -** The Administration's FY 2014 recommended funding level of $276.6 million and the House's recommendation of $315.9 for Coal Research & Development at the Department of Energy is not sufficient to accomplish the important R&D necessary to support our nation's most abundant and valuable domestic resource. The reduction in federal funds will reduce private and public investments, slow development timelines, and could cause the abandonment of promising new technologies at a time when we should be aggressively supporting the development of technologies designed to overcome environmental concerns of coal use. The CURC-EPRI Roadmap recommends $372 million per year in funding for DOE's coal R&D program for fiscal years 2014 through FY 2018.

6. **A Strategic Path Forward: The CURC 3-Part Technology Plan -** CURC members have developed a technology program that aims to insure the use of coal in a cost-competitive, environmentally superior and reliable way today and well into the future (2050 and beyond). The three-part CURC technology program is designed to encourage the use of coal in the:
   - **Near-term** by applying technology solutions to the existing fleet of coal-fired electric generating plants to better insure efficiency, output, reliability and emissions-control.
   - **Mid-term** by authorizing the construction of 10 GWs of advanced coal plants that are highly efficient and superior in ability to control emissions and that will install carbon capture systems when that technology is commercially available. A second program that provides financial incentives for the capture of CO_2 to recover crude oil while directing tax receipts and royalties (not new taxes) from that recovered crude oil to pay for the CO_2 capture systems.
   - **Long-term** by focusing federal appropriations toward a RD&D program that has the goal of cost competitive, environmentally superior, and transformational uses of coal for the future.

B.1. Who is the Coal Utilization Research Council (CURC)?

The Coal Utilization Research Council (CURC) is a coalition of coal-using utilities, coal producers, equipment suppliers and manufacturers, universities and institutions of higher learning, state

government entities, labor organizations as well as industry trade associations.[1] Our membership is joined together to promote the research, development, demonstration and deployment of technologies that will enable the long term use of our nation's abundant coal supplies in a cost-effective and environmentally acceptable manner. A listing of our members can be found by visiting our website at www.coal.org.

B.2 Why Coal and Coal Technology Are Important

Before addressing the technology-related questions posed by the Energy Subcommittee in the invitation to testify, it is important to underscore why coal remains so important to the Nation.

a. Coal is widely available, affordable and reliable

Continued and expanded utilization of America's vast coal resources is in the public's interest. Coal-based energy has long been the foundation of social and economic development in our country allowing more people to live better and live longer. Coal conversion to electricity, liquid fuels, or chemicals enables the United States to meet the ever-rising demand for energy. Clean coal technologies including higher efficiency generation and carbon capture, utilization and storage (CCUS) are pathways toward achieving sustainable energy, economic growth, and climate change policy goals. Further, affordable and reliable electricity driven by coal enables the expansion of electro-technologies, which are the basis of modern society.

Our vast, domestically secure supply of coal has fueled the American economic machine just as it is now fueling the phenomenal industrialization of China– as well as the economies of India, Vietnam, and other emerging economies. Lest we forget, given the almost daily news suggesting the demise of coal, this energy source provided 37% of the electricity generated and consumed in this country in 2012. And, the Energy Information Administration (EIA) projects in its latest Annual Energy Outlook, (2013) that coal will continue to provide approximately forty percent of our electricity needs through 2040 (the end of the EIA projection period). The reliance upon coal stretches well into our future as it remains an essential supplier of energy in the United States for decades to come.

Also, as we consider questions about climate change and U.S. regulatory programs CURC believes it is worth noting that if the United States simply were to abandon coal, a scenario that is unrealistic, the impact to global CO_2 emissions would be relatively small. To combat global CO_2 emissions, the U.S. must play a lead role in the development of technologies that can (and will) be deployed in China and India and elsewhere, to reduce global carbon emissions. Without technology innovation in this country, and initiatives sponsored and supported by the Department of Energy (DOE), a significant reduction in global GHG emissions is unlikely (see: Attachment A comparing China's growing use of coal to the U.S. and the rest of the world).

b. Coal-based power generation is important to the American economy

[1] Several members of CURC, including not-for-profit organizations as well as institutions of higher education, are prohibited from advocating public policy positions and therefore, to the extent this statement includes policy-related recommendations, such member organizations are not to be considered as associated with such recommendations.

Our coal-based power generation is fully dispatchable – when you need it, it is there. Other sources of electric power have their attributes, but may not be available when you need the electricity if the sun is not shining, if the wind is not blowing or if the costs of a fuel become volatile and not affordable compared to consistently stable, low-priced coal resources.

Our fleet of existing coal-fired power plants also provides relatively inexpensive electricity, and low cost power means that consumers keep more of their income to spend on other expenses. This also provides U.S. industry with a competitive edge over manufacturers in other countries that lack access to reliable, abundant, low-cost electricity generated from coal resources (see: Attachment B which depicts state-by-state cost of electricity and percent of electricity provided by coal). And, the availability of low-cost electricity is a key component to President Obama's recently announced initiative to grow manufacturing in the U.S. As a general rule of thumb, a 10% reduction in the cost of electricity leads to a 1% increase in gross domestic product and employment.[2] That equates to 1.5 million jobs. In short, our economy is greatly impacted by the price of electricity, which can be influenced by the timing and stringency of regulations to address emissions from coal.

c. Technology to capture CO_2 from coal can significantly aid energy security

While regulations are being considered to limit carbon dioxide (CO_2) emissions from power plants, it is important to keep in mind that we are developing effective technologies to capture CO_2 emissions from coal fueled facilities which can be used for the enhanced recovery of crude oil that remains trapped in reservoirs after primary and secondary production has been completed. Between 20 to 60 billion barrels of oil remain in numerous reservoirs in the U. S., not including the Bakken shale reservoirs where some estimate that only 3 to 5% of oil is currently recovered and billions of barrels of oil remain. [3] Carbon dioxide is the primary means by which this oil can be recovered. There are other sources of less costly anthropogenic (captured) CO_2 currently available, but if industry determines it is beneficial to recover the bulk of these remaining domestic oil resources, then coal-derived CO_2 is required because there are not sufficient alternative sources of CO_2 available to recover the quantities of crude oil available.[4] (See: Attachment C for additional information on estimated economic and technically recoverable crude oil potentially recoverable through the use of CO_2). A resolution to questions regarding storage where CO_2 is utilized for enhanced oil recovery must occur if the country is to reap the benefits of using captured carbon dioxide to recover crude oil. Further, while not all coal-fired power plants are near these oil reserves, many are located in close proximity to suitable oil fields. For example, in the Gulf Coast of the U.S., there is already a need for anthropogenic CO_2 to expand Enhanced Oil Recovery (EOR).

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[2] Climate Policy and Labor Markets, O. Deschenes, Working Paper 16111, National Bureau of Economic Research, June 2010, http://www.nber.org/papers/w16111 .

[3] See: http://www.eenews.net/energywire/2013/06/06/stories/1059982389 , quote by W.F. "Rick" Bott, president and chief operating officer of Continental Resources Inc., a current oil producer in the Bakken

[4] PowerPoint presentation by Phil DiPietro, NETL, Office of Strategic Energy Analysis and Planning, March 9, 2012

Several Department of Energy (DOE) demonstration projects are being developed right now that will integrate CO_2 capture technology with electricity generation and then offset part of the overall costs by selling the captured CO_2 to companies engaged in EOR.

d. Technology ensures continued use of coal which is essential for fuel diversity

Successful development of advanced coal technologies can best ensure that coal remains an option for the generation of electricity. And maintaining this diversity in fuel choice is a hedge against volatile fuel prices (e.g. natural gas prices) or potential scarcity of long-term supply of competing fuels, thereby better ensuring electricity generators can continue to provide reliable, uninterruptable and affordable electricity for American consumers. Residential, commercial and manufacturing consumers of power will reap the benefits of maintaining fuel options and for coal – technology is the pathway towards providing that insurance.

B.3. Coal's Current Challenges

All sources of energy face challenges in today's marketplace. Depending on the fuel form, the challenge may be cost of extraction or use, intermittency, infrastructure needs, or environmental impacts. In the final analysis, challenges usually boil down to increased costs. Coal's challenges are associated primarily with the cost of complying with an array of recent and pending Environmental Protection Agency (EPA) environmental requirements and market competition with currently plentiful, low cost natural gas. Additionally, the global economic slowdown has resulted in historically flat demand for additional electric generating capacity. The bulk of research associated with coal seeks to reduce sharply the cost for coal to meet future emission limitations through continued progress in coal technology development.

a. Significant coal plant retirements with modest coal builds through 2040

Existing coal-fired power plants are highly competitive with other sources of electricity, as demonstrated by the fact that coal continues to provide more electricity in the U.S. than any other fuel. However, the added cost of new and pending environmental regulations, uncertainty over future regulations, and other factors have led to projections that perhaps 60-80 GW of older coal-fired units (20-25% of the current 310 GW coal fleet) will retire over the next few years. A partial listing of recently proposed or promulgated environmental regulations affecting coal include rules limiting interstate transport of SO2 and NOx, the Mercury and Air Toxics Standards, revised New Source Performance Standards (SO2, NOx, and PM limits), the Coal Combustion Residuals rule (ash management), revised Effluent Guidelines and New Source Performance Standards for releases to water bodies, and revised Cooling Water Intake Structure rules. Climate change- related rules are discussed below.

With respect to the U.S. market for new power plants, the DOE/EIA's most recent Annual Energy Outlook projects that the overall electric power sector (including all fuels) will shrink from 1006 gigawatts of capacity in 2013 to 986 gigawatts in 2020. EIA projects that once 6 gigawatts of coal units now under construction commence operation (by 2015), there will be essentially no additional coal units built until after 2035, and only 1.5 gigawatts by 2040. These projections assume current regulations and do not reflect any future regulations limiting CO_2 emissions.

b. The regulation of carbon dioxide emissions and challenges for coal use

Most government-sponsored coal RD&D focuses on reducing the cost of systems to control CO_2 emissions.[5] Carbon is the major constituent of coal and it is the oxidation of carbon to CO_2 which produces most of the thermal energy produced when coal is burned. It is important to understand that, although additional regulations are under development, the EPA already regulates CO_2 emissions from new coal-based power plants through the Prevention of Significant Deterioration (PSD) permitting process. Each proposed new coal-based power plant must install best available control technology (BACT) for limiting CO_2 emissions as determined on a case-by-case basis by the permitting authority through the PSD process. Any available CO_2 emissions control technology or measure must be considered in setting a specific BACT limitation for the plant, although the permitting authority can eliminate those CO_2 control options that are technically infeasible or prohibitively expensive.

In addition to the current PSD regulation of CO_2 emissions from new coal-fueled power plants, two additional rulemakings are under development by EPA to set CO_2 performance standards under Section 111 of the Clean Air Act (CAA). Both rules will be governed by the statutory requirement that these performance standards must reflect *"the best system of emission reduction which (taking into account the cost of achieving such reduction and any non-air quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."*[6]

1. The first rule will set CO_2 performance standards under Section 111(b) that directly apply to new coal-fueled power plants.
2. The second rule will establish federal emissions guildelines under Section 111(d) that will require states to set CO_2 performance standards for existing coal-fueled power plants.

With respect to the first rulemaking, EPA initially proposed in April, 2012, a CO_2 New Source Performance Standard (NSPS) for new coal-based power plants. The proposed limit was 1000 pounds of CO_2 per gross megawatt-hour of power generation, about half the emission rate for a coal-fueled unit without any add-on CO_2 emissions control technology. The rule would essentially require the use of carbon capture and sequestration (CCS) technology on any new coal-based power plant in the U.S. CURC provided comments to EPA and noted that "there is no system of controls that has been adequately demonstrated to achieve this standard for new coal fueled power plants." CURC also stated the belief that EPA's approach to apply CCS technology after a plant had been operating for 10 years was impractical for several reasons, including the inability of a plant owner to make a large capital investment in a new plant without assurance that the CCS technology needed in 10 years would be commercially available and affordable.

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[5] The CURC does not take a position for or against potential regulations or legislation addressing greenhouse gas control but if public policy is adopted to establish a control regime then it is vitally important that cost-effective technology is available to control carbon dioxide emissions from coal use.

[6] Clean Air Act, Section 111(a).

The Office of Management and Budget (OMB) is now reviewing a re-proposal of the 2012 proposed rule, and the President has directed that this new proposed rule be issued by September 20, 2013, followed by a final rule after EPA considers public comments filed on the new proposal. The President has also directed EPA to propose the second rule, for existing coal-based power plants, by June 1, 2014, and finalize that rule one year later.

CURC members have made major financial commitments to the development and demonstration of CCS technology. With time and adequate resources, we believe that industry can demonstrate that CCS is commercially available and economically viable for utility-scale applications. Although EPA was overly optimistic regarding CCS technology in its 2012 proposed performance standards, the Agency was notably unwilling to make an affirmative determination that CCS is an "adequately demonstrated" CO_2 control technology for setting a performance standard, as required by the statute. It is essential that we not overreach the capabilities of technology in setting these standards.

In addition to the technology and cost challenges facing CO_2 capture technology, challenges exist for CO_2 storage approaches, as well. There are significant unresolved "legal framework" barriers to CO_2 storage in saline formations, including exposure to significant liabilities and risks for scores of decades after closure of the power plant. The good news is that, assuming these barriers are adequately addressed, the North American continent has promising storage sites for thousands of years of CO_2 emissions from electric power generation.[7] Again, not all power plants are located in close proximity to potential CO_2 use in EOR applications and because the source of CO_2 (i.e. power plant) is not in close proximity to any EOR field then storage in saline formations could be the only option. This means that these legal framework barriers must be addressed concurrent with the development of CO_2 capture technologies.

B.4. Track Record on Technology: Solving Challenges with Technology

Congress should be confident that challenges to the use of coal, most specifically those related to the control or capture of CO_2 from coal use, can be addressed through the successful development and use of technology. We are not there yet; significant time and financial support are required, along with a realistic understanding that simply directing or assuming the existence of technology will not make it so.

Since the early 1970s, the DOE Coal RD&D program and DOE's National Energy Technology Laboratory (NETL) have been responsible for developing innovative technologies for coal-fired power plants such as low nitrogen oxide (NOx) burners, Selective Catalytic Reduction (SCR), flue gas desulfurization (scrubbers), and fluidized bed combustion, all of which are now in the marketplace and benefitting energy production and air quality improvements.[8] In fact, today, three out of every four coal-burning power plants in the U.S. are equipped with technologies that can trace their roots back to DOE's advanced coal technology program.

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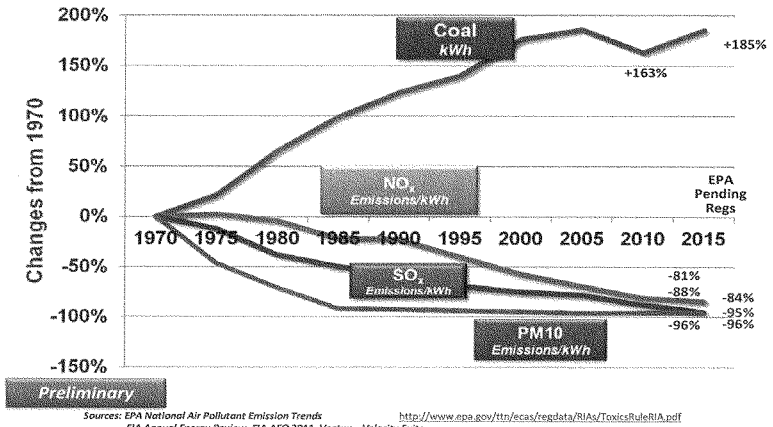
[7] The DOE/NETL atlas of geology favorable to CO_2 storage has identified deep underground saline geologies which could accommodate 2 – 20 trillion tonnes of CO_2. This range is enough to store the CO_2 from the entire U.S. coal-fueled fleet operating for 1,000 to 10,000 years.

[8] http://energy.gov/sites/prod/files/roi_factcard.pdf

The benefits from federal investment in these technologies is evidenced by the fact that coal use in this country has increased by more than 180% while the rate of emissions of criteria pollutants, such as SO_2 and NOx, has decreased by an average of 85% since enactment of the CAA in the early 1970s.

Coal-fired Generation Emission Rates



Sources: EPA National Air Pollutant Emission Trends http://www.epa.gov/ttn/ecas/regdata/RIAs/ToxicsRuleRIA.pdf
EIA Annual Energy Review, EIA AEO 2011, Ventyx – Velocity Suite

Furthermore, DOE estimates that the public and private sector RD&D collaborations through the Department's clean coal technology programs have provided great value to the taxpayer yielding a return of $13 for every dollar of federal funding spent for coal RD&D between 2000 and 2020.[9] Reducing the cost of mercury control by 50-70% helped save the industry $4 billion to $5 billion annually in implementation costs, and NETL in coordination with the private sector was responsible for the development and deployment of this technology.[10]

DOE, through NETL and its coal RD&D programs, together with cost-sharing from industry, have demonstrated that technology research, development, demonstration and deployment can be used to significantly reduce emissions from coal-fired power plants. And just as technology has been used in the past to address environmental challenges associated with coal use, we can develop technology again to address CO_2 emissions and further reduce traditional pollutant emissions, if given sufficient time and sustained government support for technology development.

[9] Ibid.
[10] Ibid.

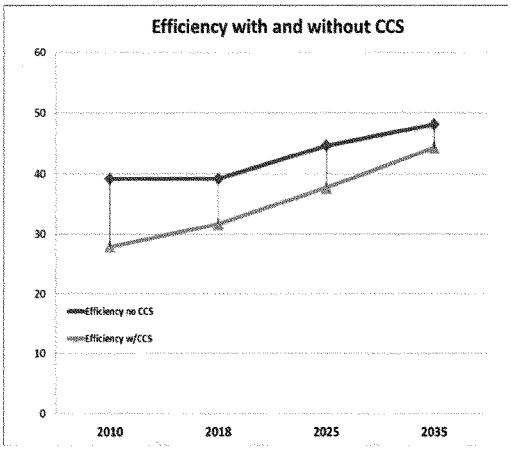
B.5. CURC/EPRI Roadmap

CURC, together with the Electric Power Research Institute (EPRI), have developed a Technology Roadmap (Roadmap) that defines the research, development and demonstration necessary to ensure that the benefits of coal utilization in the U.S. continue into the future. The Roadmap represents a plan for developing technologies that convert coal to electricity and other useful forms of energy as well as into manufacturing feedstocks. Our Roadmap and accompanying analysis concluded that several coal technology advancements, if developed, will achieve specific cost, performance and environmental goals thereby benefiting the nation's environment, economy, and energy security.

An earlier CURC/EPRI Technology Roadmap was published by CURC and EPRI in 2008. The CURC membership began updating the 2008 Roadmap in 2011 and finalized the updated Roadmap in the summer of 2012. This updated Roadmap includes new data on recent advances in technology; addresses the increased stress on the U.S. economy which has diminished our ability to support technology development; accounts for the increased supplies of natural gas; and recognized the uncertainty of policies with respect to controlling emissions of CO_2.

a. Technology Benefits

Improvements in power plant efficiency with successful R&D

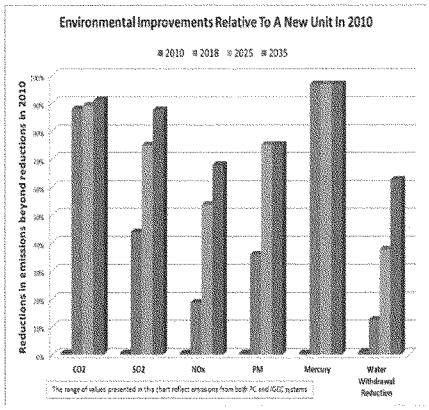


One of the most significant benefits from the proposed technology improvements identified in the Roadmap is the increase in efficiency of power generation. This improvement in efficiency reduces all emissions, including CO_2, due to less fuel being required for a given amount of electrical generation. Improvements in overall power plant efficiency for combustion-based systems as well as significant cost reductions in gasifiers and improved gas turbines are projected to result in a levelized cost of electricity (LCOE) for these advanced coal fueled systems with CCS that is lower than today's coal-fueled power plants without CCS .

Other additional benefits of successfully implementing the Roadmap include (1) aggressive reduction of water use/discharge, (2) significant reductions in traditional air pollutants and CO_2, (3) enhanced energy and economic security via production of low cost power using coal, our

largest U.S. domestic energy resource while using captured CO_2 to recover crude oil, and (4) deploying coal-based technologies for the production of liquid fuels and other marketable products.

Improvements in the control of conventional pollutants and water conservation



2010 "State of the Art" Baseline Data

Reductions reflect a range of values for both PC and IGCC technology changes after 2010, but the reductions in 2010 are very significant:

CO_2: 0% (no carbon controls in use)
NOx and SO_2: 90 - 99% reduction
PM: 99.6% reduction
Mercury: 90% reduction
Water Withdrawal Reduction (as a result of cooling towers): 98%

b. The Importance of on-going demonstrations

First, the Roadmap requires that the current suite of "first-generation" CCUS demonstration projects are fully launched and successfully operated. These projects, which are currently underway or in the planning process, are receiving or have received funding from industry and the federal government through demonstration grants (the Clean Coal Power Initiative (CCPI) or the Industrial Carbon Capture and Storage (ICCS) program) or other financial incentives (§§48A & B tax credits). It is important to note that power generation equipped with CCUS technology is not yet affordable. In fact, a number of projects selected for demonstration by the DOE through the variety of cost-share or financial incentive programs have since been cancelled. Project sponsors have concluded, even with substantial government-offered support, that continuation was not economic.

c. The need for additional demonstrations – ultrasupercritical and CO_2 for EOR

Concurrent with the need for successful demonstrations of first generation projects, it is highly important that subsequent demonstrations be undertaken. Given the prospect that the market alone will not be sufficient to undertake additional demonstrations of the technologies currently undergoing planning and construction, CURC strongly recommends that authorizations be made to encourage additional demonstrations and deployment of technology at or near commercial scale. That is the reason for our recommended mid-term program of

additional demonstrations (see discussion below). Without this continued activity during a period when little, if any, new coal-fueled power plants are projected to be built, we would lose momentum in maturing the technologies under demonstration. Further, without the prospects of additional commercialization and use, expertise and know-how will rapidly dissipate and infrastructure and even physical resources (sufficient coal resources and capacity to construct) will disappear with significant uncertainty as to whether these resources can be reconstituted.

d. Increased and targeted funding for coal-based technology R&D

This exact same need for financial and policy support for coal technology development exists with respect to continued, robust funding for the government's RD&D programs, particularly those administered by the DOE's Fossil Energy Office and conducted through NETL. That laboratory is focused upon supporting continued improvements in the development of the next generation of coal fueled technologies. These "second generation" technologies as well as "transformational" technologies, according to the conclusions reached in our Roadmap, will be deployed in the 2025 and 2035 timeframe, respectively. These future technologies have the greatest promise toward reducing the cost of CO_2 capture. As the Roadmap suggests, in 2030, if a power facility was reasonably close to an EOR opportunity, the CO_2 could become a valued commodity. In this instance, the levelized cost of electricity (LCOE), assuming we are successful in developing advanced power plants equipped with CO_2 capture(as described in the Roadmap), and selling the CO_2 for EOR, could be decreased significantly to a value of approximately $65/MWh, which is competitive with other low cost sources of electricity.

One important program being supported by the DOE program is the work being done at the National Carbon Capture Center (NCCC) which is successfully identifying and developing new and novel CO_2 capture concepts. Several hundred CO_2 capture possibilities have been catalogued at the NCCC that need to be screened, and where promise exists, NCCC demonstrations conducted. Because of on-going research efforts at this research facility and elsewhere, the earlier prospect of a 35% parasitic penalty (the amount of electricity from the power plant needed to operate the carbon capture system) is now much closer to 20%, with many opportunities to drive this energy penalty even lower.

Another key Roadmap recommendation is a "carbon storage site certification" program to characterize and qualify 5 regionally-diverse sites that can each accept 50 million tons of CO_2 at a rate of 5 million tons per year. Such a program would accelerate the demonstration of permanent CO_2 storage in saline formations and prove out the stability and safety of this method of CO_2 sequestration.

e. *Limited government and industry resources requires carefully selected areas for support*

We must focus efforts on evaluating, estimating and developing technologies that capture CO_2 affordably. The best, most reliable and efficient technology, if not affordable, will not sustain coal's continued use.

To assure affordability from the end-user's perspective, we must not ignore what the DOE and industry can afford. Restricted budgets are a reality and the Roadmap was developed with the intent of providing guidance as to how limited public funding might be used to maximize the future cost benefits of technology development. This is likely going to involve tough decisions so that the available funding is spent wisely on technologies that have the highest potential for successful widespread commercialization.

f. *Specific Areas of divergence from the FY 2014 budget request*

CURC fully supports the Administration's requests in its FY 2014 budget to continue development of cost-effective technology to capture and use or store CO_2. However, we also believe the FY 2014 Coal R&D budget may be too singularly focused on the development of CCS. There are several other areas of critical technology development that require attention and support.

For example, given the changing nature of the power generation sector and the role of other sources of electricity generation, the program should also focus on technology needs applicable to both the existing and new fleet of coal power plants by addressing improved efficiency, reliability, and flexibility in generation. The program currently lacks any emphasis on needs relevant to the existing fleet except for CO_2 capture.

Other examples of programs that are included in the CURC-EPRI Roadmap but not reflected in the Administration's proposed FY 2014 budget, include a water management program. Such a program should be designed to model water use for a variety of coal technologies as well as to develop technologies to reduce water withdrawal and consumption at power generation facilities.

Given the age of the current power generation fleet in the U.S., there exists a very significant challenge that RD&D be conducted in a timely fashion. Power plant units are aging and by the time many of these technologies are ready for commercial use, the existing coal units may simply be too old for retrofitting new technology or will be candidates for retirement. We must examine the pace of technology development and the ability to apply CCS on these units. We believe that a portion of the existing fleet will be candidates for successfully commercialized CCS technology, but that technology development cannot be postponed or delayed for lack of financial support from the government and industry. Stretching out development time due to lack of funding is not advisable. In this same regard we are concerned that many existing coal units could be retired before DOE is projecting completion of RD&D on transformational technologies such as chemical looping or pressurized oxy combustion and this existing coal fired generating capacity will be replaced with potentially more expensive non-coal fired technologies. If successfully developed in time, these transformational coal fired technologies could be realistic candidates for new power plant applications to replace retiring units. It is therefore very important that there be a serious evaluation of whether DOE's technology portfolio needs to be substantially accelerated to meet real world needs and future opportunities to deploy the next generation of coal-fueled generating units.

Finally, as noted in the CURC/EPRI Roadmap, the DOE program also should support "breakthroughs" in technology R&D across several program areas that encourage revolutionary

approaches to converting coal to useful energy and products. Importantly, the emphasis of this initiative is a focus on new ways to use coal rather than a primary focus on the capture and use, or disposition of CO_2 from coal fired plants. An example of a breakthrough technology might include the substitution of biosystems for current chemical processes. An example of such breakthrough technology might be a genetically engineered microbe that could be used to convert coal to methane or hydrogen, eliminating many sources of pollution and creating a physically more convenient form of energy (see: Attachment D for a depiction of the timelines for technology development in the CURC-EPRI Roadmap).

B.6. Budget Requirements and Implications

Government partnership support and funding commitments are critical to ensure that the goals of the Roadmap are accomplished. In order to achieve the objectives of the Roadmap funding ranging from approximately $465 million per year through 2018, $363 million per year through 2025, and then $189 million per year after 2025 is required. Of this amount, the Roadmap recommends continuation of the current R&D policy of 80% federal and 20% private or other funding for research and development activities. Accordingly, in FY 2014 through FY 2018, the coal R&D program would require $372 million per year in funding from the DOE's coal R&D program. This amount is contrasted to the $316 million that the House recently recommended in coal energy R&D for FY 2014 and the $276 million requested by the Obama Administration for FY 2014.

In summary, the Administration's FY 2014 recommended funding level of $276.6 million and the House's recommendation of $315.9 for Coal Research & Development at the Department of Energy is not sufficient to accomplish the important R&D necessary to support our nation's most abundant and valuable domestic resource.

Congress, and particularly the House of Representatives, over the course of the last several appropriations cycles has recognized the need for additional funding and we would urge such additions in the FY 2014 budget, as well (See: Attachment E for a tabular history of appropriation requests and approved levels of funding for the DOE coal R&D program).

Also, as set forth in the Roadmap, an additional effort will be needed to construct and operate commercial scale projects to demonstrate the best of these R&D products. That demonstration program has an estimated capital cost of about $6.2 billion for demonstration units built through 2025, and another $3.5 billion for demonstrations built between 2026 and 2035. None of this funding for commercial-scale technology demonstrations is currently contemplated through existing federal budgets.

B.7. Strategic Steps Forward

It is useful to step back from the detail of the CURC-EPRI Roadmap and consider coal technology development activities which could accelerate progress in meeting coal's challenges, and ensure that the country continues to enjoy, if not expand, the benefits of using coal. CURC has undertaken such an examination and is recommending that a 3-part program

be considered that consists of discrete activities targeted at the (1) near-term, (2) the mid-term, and (3) the long-term.

a. The near-term program

In the near-term, CURC believes that the key area to address is the existing coal fleet. Given the recent EPA regulations, the expanding need for flexible operation on electricity networks increasingly populated with intermittent renewable electricity generation, and the age profile of the existing coal fleet, it is important to examine existing technologies, including a determination as to whether short-term R&D aimed at compliance and improved efficiency, reliability, and flexible operation would be helpful. In suggesting this effort, CURC recognizes that a major challenge when targeting research for the existing fleet is that R&D on power systems takes time, and the time necessary to develop new compliance options can be greater than the time allowed in regulations to bring sources into compliance.

b. The mid-term program

For the mid-term, CURC recommends two programs be simultaneously undertaken. The first would take advantage of the fact that new CO_2-EOR activities enable oil production, and lead to tax revenues from profits on that oil production which would not happen absent the availability of CO_2. CURC has under consideration a proposal that would operate to provide that a portion of the new tax revenues be used to partially offset the CO_2 capture cost at coal-based power systems linked to EOR. Such a program could enable increased domestic oil production, speed CCS technology development, and provide competitively priced electricity, without increasing tax rates for individuals or industry. Success in this limited program could lead to a greatly expanded national CO_2-EOR program which would function without government assistance – creating a significant number of new jobs, improving the U.S. trade balance, and reducing foreign oil imports.

The second mid-term initiative would deploy high-efficiency coal-based power generation without waiting until complementary CCS systems can reach economic viability. This program, limited to 10 gigawatts of new generation capacity commencing service in the 2020s, would apply only to units which agree to deploy the most efficient plant designs and meet specific environmental performance criteria, with the exception of CO_2. For reducing CO_2 beyond the capability of high-efficiency operation, the plant owners would agree to install CCS technology within a designated period of time after the Secretary of Energy determines that the technology meets an affordability cost criterion, such as a certain $ per megawatt-hour or $ per tonne CO_2 limit.

c. The longer-term program

CURC's longer term activity encompasses the bulk of the CURC-EPRI Roadmap, which must be immediately implemented in order to ensure the technologies are available in the 2025-2030 timeframe contemplated in the Roadmap. We would highlight CURC's proposal for "qualifying" several regionally diverse CO_2 saline storage formations to ease the challenge for early adopters of CCS technologies; the National Carbon Capture Center as a means to test new capture

concepts without the need for time consuming and cost redundant resources for simulating a power plant environment; the need for truly transformational new technologies to minimize the cost of power from coal units with CCS; and the need to expand NETL's scope to consider traditional air and water pollutants, power plant cooling systems, and technologies to improve power plant efficiency.

C. Conclusions

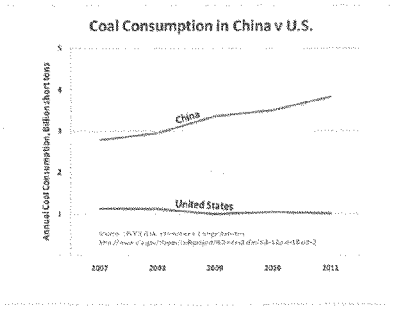
CURC wishes to thank the Committee for the opportunity to provide this statement.

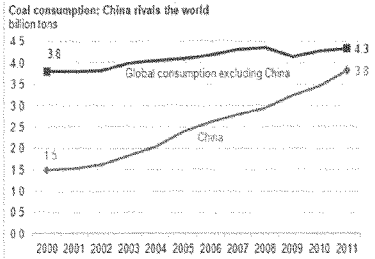
The development and then application of technology has been a key factor to the sustained use of U.S. coal resources. Advanced coal-based technologies, including CCS technologies, if given sufficient time, encouragement and sustained public support will be developed just as technologies for coal have been developed in the past. Thus, any clean energy future for this country can, and should, encompass one of the Nation's most abundant, domestic resources -- coal.

It may be worth reminding ourselves, while we encounter the musings of coal's demise that coal can point to many decades of supporting the Nation's economy, and 40 years of R&D successes in addressing environmental issues. We have cashed the dividends of coal technology investments made by our fathers, and this Committee has the opportunity to make that statement true for our children as well.

Attachment A

Coal Dominates China's Energy Supply

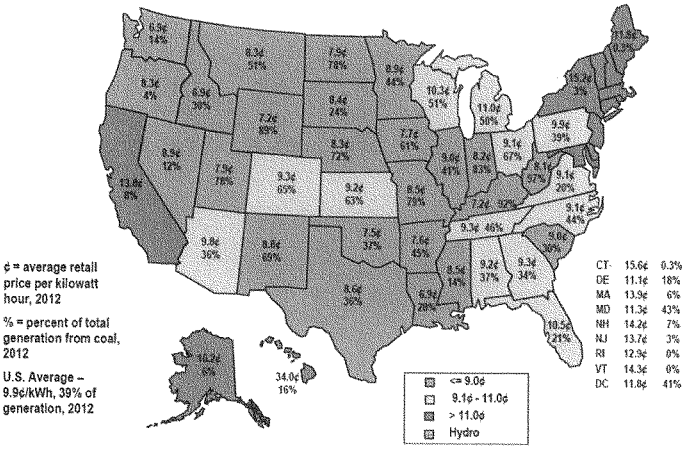




- China accounts for 47% of global coal consumption, almost as much as the rest of the world combined
- In 2011, coal consumption in China grew >9% for the 12th year of an upward trend
- China has 700 GW of installed coal capacity, compared to only 310 GW in U.S.

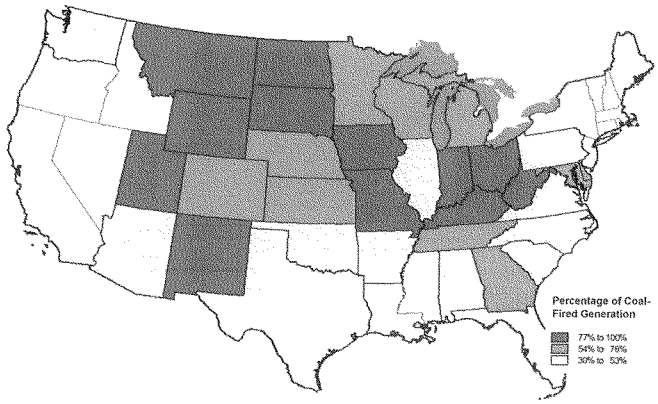
Attachment B

Cost Per kWh & Percent of Coal Power Sector Generation



Sources: Energy Information Administration, *Electric Power Monthly*, March 2013 (2012 data); Public Service Commission of the District of Columbia (2012); California Energy Commission (2011 latest available); Washington State Department of Commerce (2011 latest available); 2012 data are preliminary.

State Coal-Fired Generation Intensity



33 or 50 States produce 30% or more electricity from coal-fired generation

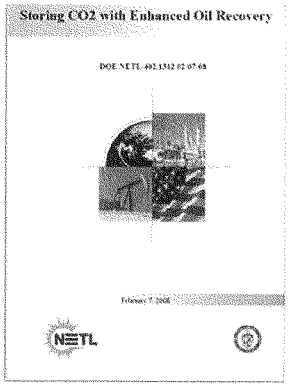
Attachment C

There is a lot of EOR

Table 7. Economically Recoverable Resources from Applying "State-of-the-Art" CO2-EOR: National Totals at Base Case Economics*

Basin/Area	Incremental Technically Recoverable (Billion Barrels)	Incremental Economically Recoverable* (Billion Barrels)
1. Alaska	12.4	9.5
2. California	6.3	5.4
3. Gulf Coast (AL, FL, MS, LA)	7.0	2.2
4. Mid-Continent (OK, AR, KS, NE)	10.6	5.6
5. Illinois/Michigan	1.2	0.5
6. Permian (W.TX, NM)	15.9	7.1
7. Rockies (CO,UT,WY)	3.9	1.9
8. Texas, East/Central	17.6	8.3
9. Williston (MT, ND, SD)	2.5	0.5
10. Louisiana Offshore	5.8	3.9
11. Appalachia (WV, OH, KY, PA)	1.6	0.1
Total	84.8	45.0

*Base Case Economics use an oil price of $70 per barrel (constant, real) and a CO2 cost of $45 per metric ton ($2.38/Mcf) delivered at pressure to the field.



23

The EOR CO2 demand greatly exceeds natural (cheap) CO_2 supply

Table 13. Economically Feasible Market Demand for CO2 by EOR: NEMS/EMM Power Generation Regions*

NEMS EMM Region	Purchased CO2 Requirements (Tcf)	Natural CO2** (Tcf)	Industrial CO2** (MMcfd)	(Tcf)	Unmet (Net) Demand for CO2 (Tcf)	(Million mt)
Region 1 - ECAR	1.1	-	15	***	1.1	59
Region 2 – ERCOT	72.2	25	110	1.2	46.0	2,436
Region 3 – PJM (MAAC)	0.1	-	-	-	0.1	4
Region 4 – MAIN	1.9	-	-	-	1.8	100
Region 5 – MAPP	2.1	-	-	-	2.1	109
Region 6 – NY ISO	-	-	-	-	-	-
Region 7 – NW ISO	-	-	-	-	-	-
Region 8 – Florida	0.2	-	-	-	0.2	9
Region 9 – SERC	43.0	8	-	-	32.0	1,695
Region 10 – SWPP	29.7	5	35	0.4	24.3	1,286
Region 11 – WECC/RMPP	7.8	-	175	1.9	5.9	311
Region 12 – WECC/RMPP	2.3	-	65	0.7	1.6	83
Region 13 – WECC/CA	26.0	-	-	-	26.0	1,377
Region 14 - Alaska	39.6	5	-	-	34.6	1,831
TOTAL U.S.	223.0	43	400	4.2	175.8	9,301
TOTAL Lower-48	183.4	38	400	4.2	141.2	7,470

*Base Case $70/Bbl oil and $45/mt CO2
**Assessed available to be produced and productively used by the CO2-EOR industry in the next 30 years.
***Less than 0.01 Tcf and thus not included in totals.

That's about 40,000 MW of coal generation for 30 years.

Bottom line: We need another 7.5 B tonnes of CO_2 for EOR.

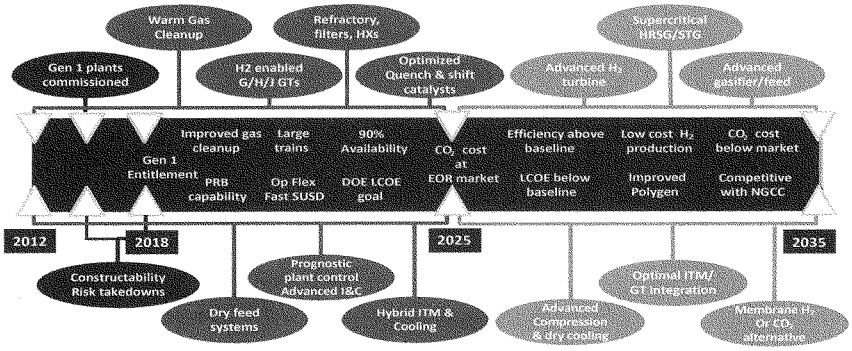
Key Assumption.

24

Attachment D

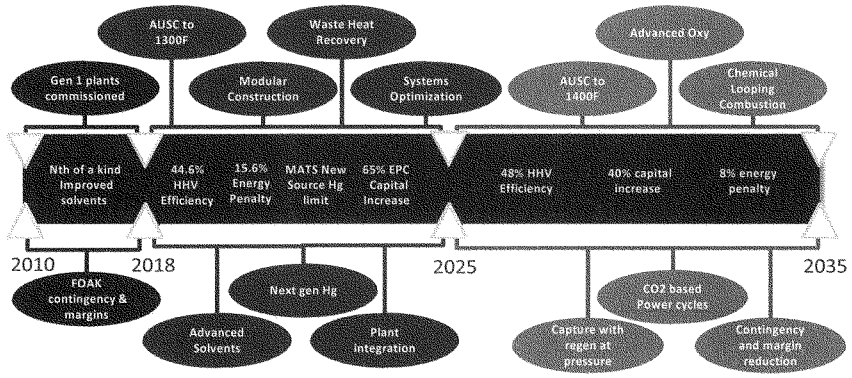
Gasification-related technologies

Gasification Timeline and Impact



Key Combustion-related technologies

Combustion Timeline and Impact



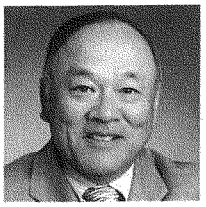
Attachment E

HISTORY OF APPROPRIATIONS REQUESTS AND ENACTED AMOUNTS

DOE CCS & Power Systems Budget ($$ in Thousands)	FY 2008 Request	FY 2008 Omnibus	FY 2009 Request	FY 2009 Omnibus	FY 2010 Request	FY 2010 Enacted	FY 2011 Request	FY 2011 Enacted	FY 2012 Request	FY 2012 Enacted	FY 2013 Request	FY 2013 CR
Coal R&D Program TOTAL	426.5	493.5	623.7	692.4	403.9	404	403.9	390	291.3	360	275.9	370

DOE CCS & Power Systems Budget *($$ in Thousands)*	FY 2014 President's Request	FY 2014 House	FY 2014 Senate	FY 2014 CURC Roadmap
Coal R&D Program TOTAL	276	315	268	404

VanNess Feldman



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J.D., George Washington University National Law Center, 1972
B.A., Harvard College, 1969

Bar and Court Admissions
District of Columbia

Ben Yamagata

Partner

Ben Yamagata's practice encompasses federal and state legislative and administrative issues in the areas of energy, environment, natural resources, international trade (technology transfer and independent power project development), and transportation-related matters.

Mr. Yamagata represents clients before the Departments of Energy, Commerce, Transportation, Defense and State, as well as the Office of Management and Budget and the Environmental Protection Agency, on both project-specific and programmatic issues that relate particularly to technology research, development, demonstration, and deployment relating to the use of coal and other fossil and renewable energy resources. Mr. Yamagata has advised clients on energy and environmental technology projects as well as provided counsel and representation in the structuring and advocacy for government programs such as the Department of Energy's clean coal technology development and demonstration programs and financial incentive programs (*e.g.*, loan guarantees and clean coal tax credits) that were authorized as part of the Energy Policy Act of 2005.

Mr. Yamagata serves as the Executive Director of the Coal Utilization Research Council (CURC), a coalition of industry and educational institutions with an interest in promoting clean coal technology.

Government Service

U.S. Senate

- Counsel/Staff Director, Subcommittee on Energy Research and Development, Committee on Energy and Natural Resources, 1975-1977
- Legislative Counsel, Senator Frank Church (D-ID), 1974-1975
- Professional Staff Member, Special Committee on Aging, 1972-1974

Chairman LUMMIS. Thank you, Mr. Yamagata.
I now recognize Mr. Collins for five minutes.

**TESTIMONY OF MR. DON COLLINS,
CHIEF EXECUTIVE OFFICER,
WESTERN RESEARCH INSTITUTE**

Mr. COLLINS. Good morning, Chairman Lummis, Ranking Member Swalwell and Members of the Subcommittee. I am Don Collins from the Western Research Institute located in Laramie, Wyoming. On behalf of everyone at WRI, we deeply appreciate the opportunity to provide testimony on the vital role of innovative scientific research and technology development that can assure a diverse energy resource portfolio that utilizes our Nation's abundant coal resources efficiently and environmentally responsibly.

WRI is a multidisciplinary scientific research and technology development nonprofit institute currently specializing in bioenergy, natural gas, emission capture, environmental monitoring and remediation, asphalt chemistry, heavy and ultra-heavy oils such as Canadian oil sands, as well as clean coal power, gasification and conversion to transportation fuels, hydrogen and industrial chemicals. So I will summarize my testimony and request that my testimony be entered into the record.

Our view is that R&D work is successful when viable technologies are deployed to the betterment of our country. So in my written testimony, I highlight opportunities to utilize carbon to achieve energy recycling for living in a carbon-rich world: utilize low-rank coal as an untapped water-rich resource, increase plant efficiencies to lower emissions of hazardous air pollutants and lower water consumption, leverage existing coal power plant investments to also clean up eco-legacy contamination levels such as for mercury, create a diversified energy technology portfolio to best serve very local conditions, and resource availability across the United States.

Based on WRI's experience and expertise, I recommend that Congress take some of the following actions: consider policies that allow exploring solutions for living in a carbon-rich world in addition to living in a carbon-constrained world; cultivate a national best portfolio strategy to leverage all energy resources and utilization technologies; formulate a flexible, integrated clean energy technology research portfolio and priorities that consider local and regional constraints; allocate funding to support the utilization of carbon dioxide to stimulate the transformation of this abundant compound from something to be avoided to a beneficial resource that can be used to increase chemical feedstocks, biofuels and support national energy self-sufficiency; allocate resources for research to support the sustainable and environmental safe use of fossil fuels, especially energy and water efficiency advancements in connection with the energy-water nexus; formulate a Federal leadership team to strategically plan advanced energy and water efficiency improvements and environmental impact reductions across the entire coal sector.

In summary, at WRI, we take a portfolio approach to provide sustainable energy solutions. Our thinking approach will deliver cost efficiencies and environmental benefits with respect to utiliza-

tion of coal. The many boom-and-bust cycles that we have experienced in the energy sector really are a function of the marketplace, but the way in which we can minimize the downside of this fact of life is through an aggressive, innovative partnership between industry, research entities and the Federal and state governments. This will ensure our energy technology portfolio will deliver benefits to the U.S. consumers and protect the environment.

I would note, for example, that the State of Wyoming is implemented a long-term strategic plan to maximize the entire energy portfolio within Wyoming, utilizing CO_2 for enhanced oil recovery and preparing for long-term storage of CO_2. These are precisely the kind of activities the Federal Government should encourage. Making the best use of limited financial investments in addition to efficient utilization of all energy resources is key to achieving national sustainability goals, energy security and economic prosperity.

In closing, a strong commitment to a portfolio approach that includes solutions for living in a carbon-rich world will facilitate innovation and sustainable economic growth that in turn strengthens U.S. competitiveness. This necessitates continued Federal funding of scientific research and technological development. It is essential to maximize the energy efficiency and productivity of our country in the most environmentally and economically sustainable ways.

Again, I thank you for the opportunity to appear before you, and I would be pleased to answer any questions the Subcommittee may have.

[The prepared statement of Mr. Collins follows:]

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TESTIMONY

Donald W. Collins, Jr.
Chief Executive Officer
Western Research Institute
Laramie, Wyoming

Submitted To The
Honorable Cynthia Lummis
Chairman

Subcommittee on Energy
Committee on Science, Space And Technology
U.S. House Of Representatives
Washington, D.C.

Hearing On The Future Of Coal: Utilizing America's Abundant Energy Resources

July 25, 2013

Western Research
INSTITUTE

Chairman Lummis, Ranking Member Swalwell and members of the Subcommittee I am Donald Collins, CEO of the Western Research Institute located in Laramie, Wyoming on the campus of the University of Wyoming. On behalf of WRI, we deeply appreciate the opportunity to provide testimony on the vital role that coal research and development activities can play to ensure a diverse energy resource portfolio that relies on our abundant coal resources. WRI has dedicated its extensive capabilities and experience to drive our use of coal in technologically efficient, environmentally responsible and cost effective manner.

INTRODUCTION

As a matter of background, WRI employs a team of 83 scientists, engineers, technicians and management professionals working on both basic and applied research, development, and technology demonstration and deployment (RDD&D). Our scientists for the past four decades have developed solutions and technologies to advance energy exploration, recovery and utilization. We also have used our expertise in the energy sector to address the needs of the public and private sectors in the fields of environmental remediation, ecosystem protection and public safety. I provide additional information on WRI and our work as background and overview about WRI is provided in Attachment A.

COAL RESEARCH ACTIVITIES

At Western Research Institute (WRI), we are focusing our coal utilization research and technology development activities to enhance the sustainability of coal through improvements in (1) utilization and energy efficiency, (2) environmental cleanliness and (3) sustainability. Below are brief paragraphs about each.

Enhancing Coal Utilization Energy Efficiency – Several process technologies were devised to increase the energy efficiency of coal power plants while also lowering criteria pollution emissions.

Enhancing Coal Environmental Cleanliness – An added benefit to enhancing coal utilization energy efficiency is the ability to address criteria pollution emissions, including carbon dioxide (CO_2). This is accomplished by lowering such pollutant emissions per megawatt hour (MWhr) delivered to the grid. WRI recognizes that knowledge has evolved regarding environmental and health ramifications associated with human activities of all types, including extraction and utilization of energy resources. We view this knowledge as valuable and help us develop appropriate priorities for research and technology development and more importantly deployed. This ensures development of a portfolio of cost-effective and sustainable technology solutions.

Enhancing Coal's Sustainability – The challenge for coal from a sustainability perspective is that coal resources removed carbon dioxide from the atmosphere hundreds of millions of year ago when the naturally occurring processes of that era resulted in the creation of coal from biomass. This ancient age of coal relative to conventional biomass energy systems presents a great challenge to any notion that coal can contribute to sustainability within the much shorter time spans considered appropriate for sustainable clean energy models.

To tackle this timing challenge of energy system CO_2 recycle ability and to achieve sustainable energy systems, WRI is focused on the opportunity to invent ways to recycle all carbonaceous forms of energy to include coal. To date, humans have devised solutions to recycle many products such a paper, plastic, metals, batteries, etc. to extract and reuse the materials and in turn achieve economic and environmental benefits. Now via biological sciences applied to our fossil energy resources we are at the forefront of achieving the capacity to recycle carbonaceous energy.

At their core biomass, coal, petroleum, and natural gas are energy resources that contain two primary energy carriers – carbon and hydrogen. By conventional wisdom, burning wood is viewed as "carbon neutral" from a sustainability perspective based upon the amount of CO_2 emitted through burning equaling the amount of CO_2 trees took from the atmosphere to grow. This leads to the conventional view that burning wood is a sustainable carbon neutral energy system[1] that does not result in a net increase in atmospheric levels of CO_2 (a greenhouse gas) as does the combustion of traditional fossil fuels such as coal and natural gas. From a sustainability systems view, burning coal yields a net increase in atmospheric CO_2 inventory is ultimately a timing and rate/speed issue due to the fact the original biomass, from which coal is created, is about 300 millions old and trees living today do not consume atmospheric CO_2 at a rate fast enough to recycle the amount of CO_2 produced from burning coal, natural gas, and petroleum transportation fuels.

WRI is conducting research to quicken the conversion of CO_2 emissions from coal, natural gas and cement plants into a more timely useable form of energy – biological crude oil (biocrude). Our primary research activity involves developing two biotechnology related

[1] The Partnership for Policy Integrity (PFPI) life cycle analysis work challenges the notion that burning wood in commercial and utility scale energy plants is a carbon neutral sustainable energy system. In a review of the Manomet Biomass Sustainability and Carbon Policy Study performed for the Clean Air Task Force comparing carbon emissions between biomass and fossil fuel power plants, PFPI concluded, "**For utility-scale generation, net emissions are higher from biomass than fossil fuels.** When biomass is used to generate electricity in utility-scale plants, the net emissions after 40 years, even taking forest regrowth into consideration, are still higher than if the power had been generated with natural gas or coal." In discussing the Manomet study assumptions, PFPI stated, "To the extent that these assumptions are not warranted, the Manmet study has underestimated the net carbon emissions of biomass power, and policy-makers should be extremely cautious about accepting the study's optimistic conclusions concerning the point in time when biomass can start providing a carbon dividend."

processes to capture and convert CO_2 using chemoautotrophic (CAT^{TM}) bacteria. CAT^{TM} bacteria continuously consume CO_2 without requiring light. Bench-scale research results are extremely promising, and system-level modeling and simulation estimate synthetic diesel production costs a $3 to $5/gallon. By changing our mindset away from conventional thinking in which CO_2 is viewed solely as a threat to our planet and human life we were able to explore ideas to utilize CO_2 that provide societal and economic value.

Our endeavor was to devise a technological solution that consumed significantly less energy and financial resources compared to carbon capture and underground sequestration (CCS). We also discovered that it would be possible to produce chemical feedstock to provide an alternative to petrochemicals that can help meet growth in global consumption. Our aim is to avoid expenditure of valuable energy and limited financial resources for underground CCS for which no additional societal benefits beyond containing atmospheric CO_2 inventory levels are achieved. Applying the WRI CAT^{TM} Process as a CO_2 recycle accelerator we see the potential to achieve the goal of anthropogenic CO_2 emission reduction via a societal integrated and economically sustainable systems approach.

Our preliminary assessment of net societal/national CO_2 emission reduction is based primarily upon the integration opportunity for two existing large societal sector CO_2 emitters: (1) the power sector and (2) the transportation sector. Applied to the power sector, the CAT^{TM} process can reduce CO_2 power plant emissions which are then converted into a synthetic diesel fuel for the transportation sector. The integrated societal energy system CO_2 reduction results when the synthetic diesel is used to displace conventional diesel consumption – achieving a second use of the carbon within coal prior to the eventual CO_2 emission from vehicle exhaust pipes. While the transportation sector CO_2 emissions are not directly reduced, the fact that the CAT^{TM} biodiesel fuel prevented power plant CO_2 emission from entering the atmosphere we achieve an integrated societal system reduction in CO_2. A descriptive formula comparison of Today (without CAT^{TM}) and a Future (with CAT^{TM}) illustrates the how an integrated societal energy system achieves lower net CO_2 emissions:

Today's Total CO_2 (without CAT^{TM}) =Power Sector CO_2 + Transportation Sector CO_2 + Other CO_2 Emitters

Future Total CO_2 (with CAT^{TM}) =Power Sector CO_2 <u>lowered by 80% to 90%</u> + Transportation Sector CO_2 + Other CO_2 Emitters

A calculation performed in 2011 based upon the U.S. coal fleet at that time estimated a potential net national CO_2 emission reduction of 40% to 50%. On the economy and

domestic jobs front, WRI's CAT™ process can help build a new component within the domestic petrochemical sector that could create long-term career jobs in every state.

The large financial investments made to build the coal power plant fleet in the United States provides an opportunity to leverage the sustainability goal with lower new financial investments and lessens diversion of limited funds away from other state and national needs. WRI's research includes evaluation of biomass blended with coal to aid farm and forestry states with significant amounts of refuse biomass to maximize their clean energy mix and to provide new market opportunities to the farming and forestry industries by leveraging existing coal plant financial assets.

One technology developed with an industry partner to dry and upgrade the energy value of low-rank coals is now being commercialized to enhance the utilization of woody biomass for energy plant feedstock. This WRI coal drying process applied to biomass is called torrification and produces charred wood pieces that possess an equivalent grindability index performance as coal. Grindability is critical if a material is going to be used in the production of energy through gasification. The result is that biomass can be blended with coal and used to leverage existing coal power plant investments.

A yet to be realized environmental benefit lies in the opportunity to leverage coal power plant emission capture systems to capture criteria hazardous air pollutants (HAPs) such as mercury and arsenic that exist within the biomass energy resources. Yes, biomass does possess several criteria pollutants. In addition, as reported by the Partnership for Policy Integrity (PFPI) paper, "Air pollution from biomass energy" updated April 2011, biomass energy plants emit greater amount of certain criteria HAPs than is emitted from coal power plants. PFPI identified, "The HAPs emitted in the greatest quantities by burning biomass include the organic HAPs styrene, acrolein, and formaldehyde, and acid rain gases hydrofluoric acid and hydrochloric acid...Even "clean wood" – that is forestry-derived wood, as opposed to construction and demolition debris – emits these chemicals when burned. Burning clean wood also emits non-negligible amounts of heavy metals." A copy of the paper by the Partnership for Policy Integrity is attached at the end of this written testimony.

On July 12, 2013, the Partnership for Policy Integrity reported on the United State Court of Appeals ruling against the United States Environmental Protection Agency (EPA) that the EPA could no longer allow exempting CO_2 emissions from biomass power plants for purposes of Clean Air Act permitting. The Partnership for Policy Integrity provided expert testimony for the case and reported, "Most new biomass power plants are fueled with wood, and emit 40 – 50% more carbon dioxide than a coal plant, per megawatt-hour electricity generated. The court's decision could affect how states choose to incentivize

biomass energy in the future. Massachusetts has already made low-efficiency biomass power plants ineligible for subsidies, based on the large amount of CO_2 they emit."

We see a substantial opportunity via the combined utilization of biomass with coal power plants to lessen human and wildlife health risks by lowering the inventories of HAPs such mercury and arsenic existing in the environment and food-chain. We view this as a very worthy goal given that it is ***the existing quantity of mercury in the ecosystem that has been deemed a human and wildlife health hazard***. We believe this allows policies to explore and implement solutions to reduce the quantity existing in the ecosystem in addition to reducing new emission contributions.

Just as happened with coal, biomass accumulates various elements and compounds. Both produce HAPs during combustion. By working with these processes of nature in which coal and biomass accumulate hazardous substances such as mercury and arsenic and co-feeding this contaminated biomass with coal we can assist in lowering the quantity of mercury and arsenic already existing in the ecosystem and food-chain. This presents an opportunity to integrate biological based environmental remediation for mercury and arsenic via biomass and thereby leverage the investment in multi-HAPs capture control technology installed on coal power plants. The result being an integrated clean energy solution that not only reduces new emissions of mercury and arsenic but perhaps more importantly combines to lessen the existing human and wildlife health risk by cleaning up the unsafe levels already in the ecosystem.

Given that 50% or more of the annual mercury deposition quantity in the U.S. is from foreign sources, we believe that lessening the human health risks will require some means to reduce ecosystem mercury levels in addition to lowering domestic mercury emissions. Integrating the natural process of biomass to uptake contaminants within the ecosystem with existing and coordinated emissions control investments to coal power plants we see an opportunity to achieve lower health risks by lowering the quantity of contaminants within the environment and food-chain. Utilizing the existing coal power fleet provides readily available asset investments to which to retrofit additional emissions control technologies.

WRI recommends that the efficient utilization of energy and financial resources is a key to achieving sustainability goals and energy security. This includes:

1. Coal Upgrading/Drying with added benefits of criteria pollutant removal and lower/elimination of coal fines during rail transport
2. Coal and Coal/Biomass Gasification
3. Coal to Alcohols and Chemicals

4. Hydrogen and CO_2 Capture/Separation
5. WRITECoal emission management and water utilization for low-rank coals
6. Secondary Biogenic Coalbed Methane
7. Biological CO_2 Capture and BioCrude Oil production
8. Mercury Continuous Emission Monitoring (CEM)

KEY CHALLENGES

- investment uncertainty and risk due to unstable regulations;
- large investment amount required to support pilot-scale and demonstration scale technology de-risking stages of technology advancement;
- new large energy process "game changing" technology takes decades from research conception through pilot, demonstration and commercial scale deployment;
- biomass energy density is significantly low compared to coal such that its applicability for all states as a sustainable energy resources is constrained by the fact that long distance transportation energy consumption beyond 80 to 100 miles can exceed the energy contain within the young biomass; and,
- the segregated nature of the coal and power industry business components results in a lack of integrated strategic planning and implementation from resource extraction, to conversion (i.e., electricity) to power transmission and distribution, and integration of distributed energy resource (DER) utilization technologies, especially intermittent DER technologies.

UTILIZATION OF LOW-RANK COALS

- **Chemoautotrophic (CAT^{TM})** carbon capture bacteria create a biological crude oil that can effectively recycle CO_2 through production of alternative petrochemicals for use in the chemical industry or even as fleet biodiesel fuel. We started our research looking for ways to lower the energy consumption and financial investment resources estimated to be required for conventional underground CCS approaches. Our goals were to provide a lower cost approach that also had geographical flexibility by not being limited to the available geological formations capable of sequestering carbon dioxideation. As WRI advanced this technology we came to understand that it could change the entire perspective about CO_2 being solely a negative planetary and human health hazard and think about CO_2 as a beneficial resource to aid sustainability and energy security national strategic goals. A summary of the WRI's CAT^{TM} process technology is provided in Attachment B.

- **Recycling Energy:** The U.S. Department of Energy (DOE), Energy Information Administration (EIA) and the International Energy Agency (IEA) estimate large growth in

world energy consumption through 2035. A key contributor to the growth is the increasing economic expansion in emerging country economies that is moving existing populations from subsistence living conditions to middle class consumerism life styles. This global economic megatrend is a major factor in projections of accelerated consumption of all natural resources on our planet and emissions from extraction and utilization of energy. Attachment C provides a summary of the EIA and IEA projections.

This has motivated WRI to increase our research focus aimed at increasing energy efficiency and devising practical technologies that recycle energy similar to the growth in recycling of paper, plastic, metals, asphalt pavement, etc. Carbon-containing molecules are a key output from both fossil and biomass energy plants that we can work with to invent energy recycle technologies such as our research on WRI's chemoautotrophic process technology described above. By capturing and utilizing CO_2 emissions from large CO_2 emitters such as coal power plants and in turn producing bio-based petrochemical alternative feedstock it is possible to reduce foreign oil imports and their associated emissions. Applied to the current coal power plant capacity within the U.S. a national CO_2 emission reduction of 40% to 50% is estimated. This could achieve a national carbon footprint comparable to natural gas electric power generation plants. An energy systems integration approach creates opportunities to establish a new component within the energy sector that supports jobs nationwide. This provides opportunities to lower the U.S. foreign trade deficit enabled by lower manufacturing costs, retaining domestic cement production, and increasing domestic transportation fuel production.

WRI helped to create a Zero Carbon Data Plant demonstration occurring in Cheyenne, Wyoming. This public-private partnership project, including Microsoft, FuelCell Energy, the City of Cheyenne, the University of Wyoming, Cheyenne Light Fuel and Power, Wyoming Business Council and WRI, leverages a bio-chemical carbon recycle system within nature to achieve a carbon neutral power plant for a Microsoft modular data and computational server. This Zero Carbon Data Plant demonstration facility is designed to use biogas from the Cheyenne Board of Public Utility's Dry Creek Water Reclamation Facility using a molten carbonate fuel cell plant from FuelCell Energy to produce clean power for a Microsoft server module. Future research opportunities include testing and evaluating utilization of CO_2 emitted from the fuel cell and recycling CO_2 through the WRI CAT™ process thereby increasing societal economic sustainability and environmental benefits.

Such opportunities allow us to use innovation to create solutions to pressing issues and needs. As is the essential nature of research we strive to find opportunities where

problems are identified. Our thinking therefore must be unconventional so that we may create positive step changes in technological possibilities. By applying unconventional thinking about the problem of CO_2 as an environmental and health hazard to be treated and disposed of as a hazardous substance, we are opening our minds to invent ways to turn CO_2 from an underutilized resource into a key energy portfolio resource to achieve great gains toward sustainable societal goals.

- **WRITECoal™** enhances the value and utilization of low-rank (high water content) coals by extracting the water at power plant input for later use within the plant. This results in lower local water consumption to supply plant makeup water with an estimated 50% to 60% lower water consumption. We think that this is important for water stressed regions of the U.S. The technology was first developed to remove mercury (Hg) prior to feeding coal into the plants thereby simplifying the Hg capture. We project Hg capture of 90% or better depending upon the quantity of Hg locked in the pyrite rock existing within the coal feed. The coal-bound Hg is easily removed whereas the Hg in pyrite is physically locked into the rock material and is not readily liberated for capture. Jigging equipment can be used to remove the pyrite, thereby achieving very high Hg emission capture percentages.

  WRI, also, sees substantial capture of arsenic and selenium and developed multi-pollutant capture technologies to increase the effectiveness of capturing more than just one pollutant. Most capture technologies tend to be highly selective and quickly saturate with one pollutant thereby allowing the other pollutants to flow out the stack with negligible capture percentages. Attachment D provides a summary of WRITECoal™.

  While increasing coal power plant efficiency 3 to 4%, capturing >90% of the mercury and lower CO_2 capture cost, WRI's technology turns the water in PRB coal from a price limiter into a valuable asset. WRI's WRITECoal™ pretreatment utilizes waste heat from coal power plants to evaporate the water which is collected for later use in the plant, thereby delivering usable water with low-rank coals. This is especially important in arid and drought stricken regions of the U.S. where water shortages are increasing.

- **In-Situ Biogenic Coal Extraction** technology developed by WRI entails an advanced system for in-situ enhanced biogenic methane production from coal using naturally occurring microorganisms that normally live in coal. This technology extends the life of current coal bed methane well and pipeline investments, and allows the revitalization of abandoned, played-out wells. Additionally, this technology can produce methane from

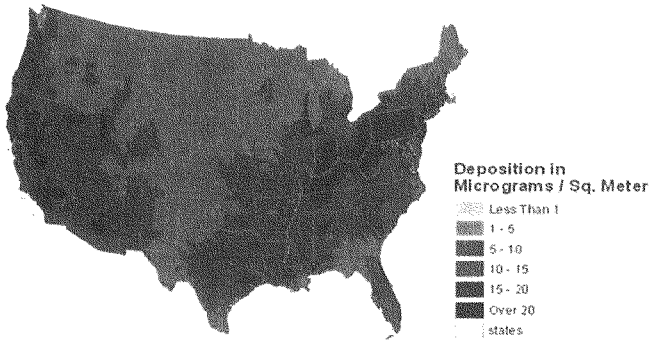
low-rank coal deposits and high-rank "stranded" coal deposits that are currently beyond the reach of financially viable mining technologies. This in-situ biogenic extraction technology, summarized further in Attachment E, is designed to increase domestic methane reserves beyond what is currently estimated by the DOE EIA.

- **Coal Dryer Energy Enhancer** technology increases the energy value of low-rank coals from approximately 8,200 to 11,500 British Thermal Unit/pound (BTU/lb) while also significantly lowering mercury (Hg) content and removing coal fines prior to transport. This is essentially a mine-mouth process that enables removing Hg at the mine site for safe disposal during mine back fill and site restoration to high quality wildlife habitats. A benefit sought by commercial deployment of this technology is to enable a near-zero mercury coal for export that would help lower Hg deposition in the U.S. (mainly western states) from the burning of coal in Asian countries and emissions carried by trade winds to the western U.S.

- Another four projects represent a second integrated program aimed at moving Wyoming up the value chain in energy with technologies to produce liquid fuels, industrial chemicals, and hydrogen while also lowering the cost of CO_2 capture. One of the technologies miniaturizes reactor size through delivering 4 to 5-times better thermal and chemical reaction performance. Another technology substantially improves mercury capture efficiency.

LOWERING MERCURY CONTENT

Understanding Mercury Human and Wildlife Health Risks – As shown in the next figure, high levels of mercury exist in the ecosystem of western states and the Upper Ohio Valley.



Source: US EPA 2005 using Community Multiscale Air Quality model.

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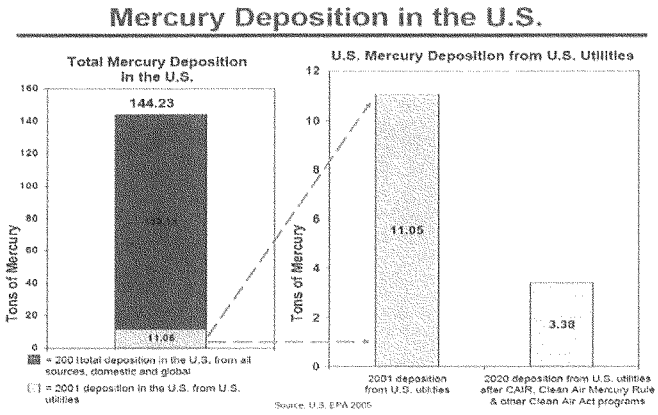
Another key piece of factual data published by the U.S. EPA in 2005 illustrated in the next chart is that of the 144.23 tons of mercury deposited in the U.S. in 2001 only 11.05 tons (7.7%) came from U.S. utilities. Furthermore, mercury emissions for U.S. utilities were projected to decline to 3.38 tons by 2020 as shown in the chart below.



Also, reported by the U.S. EPA is a breakout of domestic mercury emitters illustrated in the next bar chart. U.S. Utility Coal Boilers represented about one-fourth the total domestic mercury emissions prior to 1999. A key policy question worthy of consideration is, "What is the cumulative contribution by various sources to the mercury existing in the U.S. ecosystem?" Based upon the three EPA data charts regarding mercury, it seems apparent that the majority of mercury existing within the ecosystem and deemed a human and wildlife health hazard are primarily attributable to sources other than the U.S. Utility Coal Boilers. This begs the next questions, "Could combined policy that includes removal of mercury from the ecosystem and reducing new emissions best achieve lowering of the human and wildlife health hazard?"

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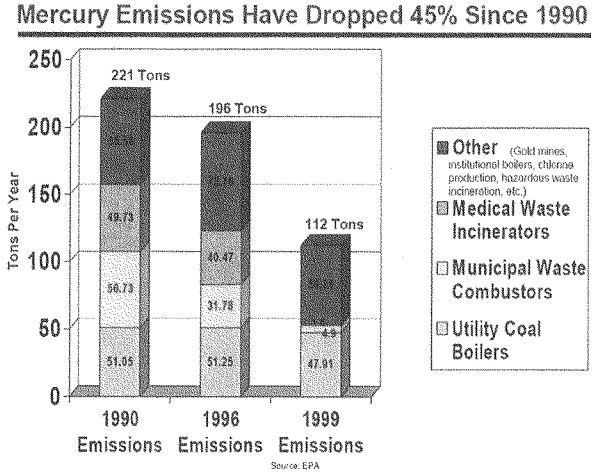
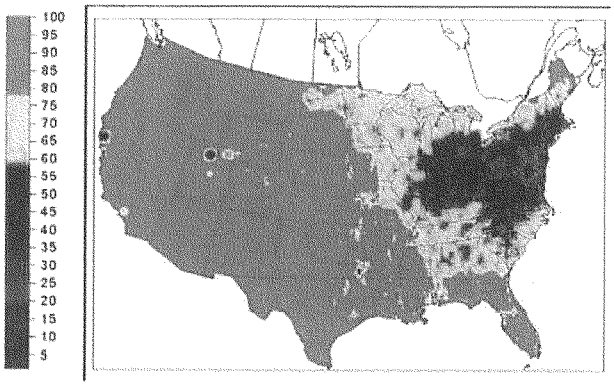


Presently, a large percentage of new mercury depositing in the western states is attributable to coal burning power plants and cement production in Asia. The figure below from the Electric Power Research Institute (EPRI) illustrates the percentage of mercury from foreign sources depositing in the U.S. The amount of mercury depositing in these states is expected to increase over the next few decades due in large part to predicted economic growth in Asia. The WRI Coal Drying Energy Enhancer technology described above provides a means to remove nearly all mercury from low-rank coals prior to export to Asian markets. This provides an U.S. developed technological solution to protect western states from growth in future mercury deposits while dealing with the practical reality of environmental and economic policies in other countries.



Percent of mercury deposition originating outside the United States {Source: EPRI}

Continuous Emission Monitoring for Mercury we worked with the Electric Power Research Institute (EPRI) and the National Institute for Standards and Technology (NIST) with funding support from the U.S. DOE and the Environmental Protection Agency (EPA) to advance Continuous Emission Monitoring (CEM) protocols and evaluate/improve the CEM equipment.

CARBON CAPTURE AND SEQUESTRATION (CCS) TECHNOLOGIES

Our thinking has evolved to consider CO_2 as an economically productive and valuable resource that facilitates national security and competitiveness in the global economy. We are focusing our ingenuity to maximize "Sustainability for Living in a Carbon-Rich World." In addition, to using biotechnology to convert CO_2 into a chemical feedstock for U.S. manufacturers to produce higher value products, there is significant economic potential to utilize the domestic supply of CO_2 to increase domestic oil production using CO_2 enhanced oil recovery techniques. Creating the infrastructure and connecting the various business opportunities could enable energy intensive industries, such as manufacturing and data centers, by providing an income stream from sale of their CO_2 emissions to other industries that can recycle/reuse the CO_2. Our view is that creating the market demand for CO_2 will be far more effective and beneficial for the overall U.S. economy than solely implementing a CO_2 emission reduction policy approaches.

Our colleagues within the University of Wyoming, Wyoming Geological Survey, Wyoming Pipeline Authority and Governor Matt Mead's office are implementing long-term strategies to manage carbon dioxide. For example, the state of Wyoming has developed a strategy to expand the CO_2 pipeline network throughout the state to maximize enhanced oil recovery over the next couple of decades while preparing the infrastructure for delivering CO_2 to underground sequestration facilities. Full implementation of this strategy will form a long-term public-private partnership to address the concerns for CO_2 emissions while providing economic wealth creating business and job opportunities for the oil sector. In addition, the state of Wyoming has provided approximately $70,000,000 for clean energy research and development to advance environmentally safe coal utilization, oil, natural gas, wind, nuclear, solar, geothermal and hydropower technologies. The state is pursuing an "All-of-the-Above" energy research and technology development portfolio strategy that includes integration across traditionally segregated energy sectors and within sectors, such as coal. Coal is perhaps one of the most segregated vertical subsectors with the energy sector. This has essentially blocked strategic investment in research across the subsector due to lack of a single entity positioned to coordinate long-term strategic planning and investments to resolve environmental concerns.

The WRI chemoautotrophic (CAT^{TM}) CO_2 utilization technology mentioned earlier is a biotechnology invention that creates economically beneficial uses for CO_2. WRI is bringing forth a technology that allows thinking about CO_2 as a long-term beneficial resource that can

facilitate achieving economic sustainability and energy security while increasing wealth creation to bolster economic prosperity in all states.

RECOMMENDATIONS

Based on WRI's experiences and expertise, I recommend that Congress take the following actions:

- Formulate a flexible integrated clean energy technology research investment portfolio and priorities to achieve best performance within local and regional constraints.
- To affect a Best-Portfolio National Approach, a national strategy for "All-of-the-Above" energy resources and utilization technologies needs to accommodate:
    - the real-world substantial differences in local energy resources,
    - weather, altitude, water availability, wildlife and infrastructure assets,
    - differences in local energy consumption and the purpose of that consumption,
    - consumption of energy locally and the associated emission footprint to supply end-use energy for consumption by other states necessitates that Federal mandates for states should provide goals to energy producing states that differ from energy consuming states,
- Consider policies that allow exploring solutions for Living in a Carbon-Rich World in addition to Living in a Carbon-Constrained World,
- Consider allocating increased funding to support the utilization of carbon dioxide to stimulate the transformation of this abundant compound from something to be avoided to something which can be used to increase chemical feedstocks, biofuels and support national energy self-sufficiency,
- Allocated resources for research to support the sustainable and environmentally safe use of fossil fuels, especially energy efficiency advancements.
- Federal government take the leadership role of strategically planning and advancing energy efficiency improvements and environmental impact reductions across the entire coal sector.

CLOSING REMARKS

WRI has taken an integrated approach to provide sustainable solutions that bring down the costs of energy production and utilization of coal and other traditional resources by combining our knowledge base with emerging technologies. The many boom and bust cycles that we have experienced in the energy sector are a function of the marketplace. The way in which we can minimize the downside of this fact of life is through an aggressively innovative partnership between industry, research entities and the federal and state governments. This will ensure

that our energy technology portfolio will deliver benefits to the U.S. consumer and protect the environment.

I would note , for example, that the state of Wyoming is investing in and implementing a long-term strategic plan to maximize the entire energy portfolio within Wyoming while positioning infrastructure to address CO_2 long-term storage. This is precisely the kind of activity the federal government should encourage. Making the best use of limited financial investment resources in addition to efficient utilization of energy resources is a key to achieving national sustainability goals and energy security.

In closing, a strong commitment to this kind of portfolio approach that avoids a one size fits all solution, will facilitate innovation and sustainable economic growth. Continued Federal funding of scientific research and technology development is essential to enable maximizing energy efficiency and productivity of our country in the most environmentally and economically sustainable ways.

Again, thank you for the opportunity to appear before you. I would be pleased to answer any questions the Subcommittee may have.

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ATTACHMENT A

OVERVIEW OF WESTERN RESEARCH INSTITUTE

Located in Laramie, WY, Western Research Institute (WRI) is a team of 83 scientists, engineers, technicians and management professionals working on both scientific research and applied RD&D to bring forth scientific knowledge, solutions and technologies in the fields of energy, environmental remediation and emission control, and longer lasting highway materials.

WRI's historical beginnings in Wyoming start in 1924 supporting high sulfur oil processing in Wyoming. WRI was established in 1983 when the U.S. Department of Energy (DOE) de-federalized the Laramie Energy Technology Center. The state of Wyoming via the University of Wyoming (UW) created and implemented a plan that retained the laboratory assets and jobs in Laramie by establishing the University of Wyoming Research Corporation d/b/a Western Research Institute as an independent nonprofit 501(c)3 cooperating entity with UW, though not UW or state employees. The resources saved by the state include a 22-acre research park in Albany County located just north of Laramie and the former DOE Laramie Energy Technology Center (LETC) building on the northwest corner of the UW campus. WRI retained ownership of the 22-acre park environmental issues and ownership of LETC building was transferred to UW. Presently, WRI leases space from UW its laboratories and office spaces within this building.

WRI's Mission Statement reflects the broad scope of topics, national and global based market sectors and beneficial contributions pursued.

WRI Mission Statement

- **Western Research Institute provides sustainable societal benefits by solving complex science and technology problems.**
- **We collaborate with partners to define the challenges, extend the body of knowledge and deliver innovative solutions in energy, environment and transportation technologies.**

Given the lengthy one to two decade timeframe to invent "Game-Changing" energy process plant technologies that achieve societal goals and then scale up that invention into commercial viable plants, it is vital to monitor megatrends in addition to the identified current day issues and needs. As researchers and technology developers within the energy sector it is vital that we target our early stage research problem and opportunity statements on the future challenges and opportunities requiring solutions 10 to 20 years from today. This strategy provides a research and technology pipeline with technologies nearing and ready for commercial deployment while preparing scientific knowledge and new inventions to address the problems and megatrend opportunities a few decades into the future.

Key highlights of WRI illustrated the agility and adaptability to adjust to changes in industry technology solution needs and regulations include the following:

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1. WRI is a multifaceted organization with a highly diverse suite of expertise, staff experience, intellectual property and research and technology development equipment and facilities.
2. WRI's clients, research partners and stakeholders are very diverse with both local, national and international market interests and business operations.
3. WRI consists of three Business Units: *Energy Production and Generation* (EP&G), *Waste and Environmental Management* (WEM), and *Transportation Technologies* (TT).
4. WRI's business portfolio has evolved to follow the needs of the various market sectors served by WRI and consists of a majority of applied Research, Development and Demonstration (RD&D) with a strong basic scientific research component with TT and as needed scientific research within EP&G and WEM.
5. Strong collaborative with universities such as the University of Wyoming and junior colleges to assist in educating and developing the skilled workforce talent people to support quicken commercial deployment of successful research and technology developments.
6. Over the past three years, WRI has substantially diversified its client base to foster an increase in commercialization of our research and technologies. This diversification shift to commercial industry partner applied research achieved a 47% increase in FY2013 over FY2011. A further growth of approximately 50% in commercial business for FY2013 versus FY2012 has been continued this focus on industry commercial viable research and technologies.

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ATTACHMENT B

CAT™ Process: A CO_2 Capture and Re-Use Technology for Fossil Fuel Plant Emissions

Coal utilization will continue to be a key factor in meeting the energy demand both domestically and internationally in the near future (Bauer, 2009). As shown in Table B-1, coal use and CO_2 emissions in the U.S. are expected to increase in the next few decades from 23 to 26 quadrillion Btu per year and 2.1 to 2.5 billion metric tons/yr, respectively. Additionally, CO_2 emissions from the transportation sector are predicted to be equal to that of emissions from coal by 2030. If emissions from one of these CO_2 sources could be reduced, then up to a 40% reduction in emitted CO_2 could occur. Without accelerated technology development to address CO_2 reduction, along with options for efficient and greener forms of energy supply from coal-based technologies, coal use and indirectly the economic progress of the country will be severely impacted. WRI's patent-pending CAT™ process could be used to capture, for example, coal-fired CO_2 emissions and produce biodiesel that replaces petroleum diesel, thus lowering the rate of CO_2 emission into the atmosphere.

Table B-1. Dominance of Coal in Energy Supply and CO_2 Emissions

Energy Source	Unit	Energy Use		Unit	CO_2 Emission	
		2006	2030		2006	2030
Coal	QBtu/yr	23	26	bmt/yr	2.1	2.5
Gas	QBtu/yr	22	24	bmt/yr	1.2	1.3
Nuclear	QBtu/yr	8	9			
Oil	QBtu/yr	41	38	bmt/yr	2.6	2.6
Renewables	QBtu/yr	6	14			
Total	QBtu/yr	100	111	bmt/yr	5.9	6.4
Change (Total)	%		11	%		8.0

Table from EIA, 2009.

The CAT™ Process. WRI's patent-pending CAT™ process is a novel biological carbon capture and re-use technology that can be added to stationary carbon dioxide emitters. This technology is not dependent on light, which affords it a number of advantages over current algal technologies. Current research and development efforts are concentrating on use of the CAT™ process for biodiesel production, but this process could be used for generation of other fuels and chemicals. Our models predict that biodiesel can be produced for approximately $3 to $5/gallon using the CAT™ process. This promising technology is currently at the research and development stage and is in need of funding opportunities to bridge the

"valley of death" in the funding landscape, which correlates to the technology development phase between early research and development and pilot scale technologies.

The CAT™ carbon capture and re-use process offers a safe and reliable alternative to geological storage, in addition to providing a low cost carbon capture technology to the emitter. WRI's CAT™ process competes with other cutting edge biological CO_2 capture technologies in terms of net efficiency, capital costs and plant availability. Deployment of the CAT™ technology would enhance the economic and energy security of the U.S. through the development of a technology that will (1) effectively capture CO_2 from stationary sources, (2) produce energy-dense, infrastructure compatible liquid fuels/bioproducts from CO_2, thereby reducing petroleum imports and CO_2 emissions (Figure B-1); and (3) minimize the efficiency reduction and financial expense of GHG emissions controlled facilities, such as industrial and manufacturing facilities and utilities.

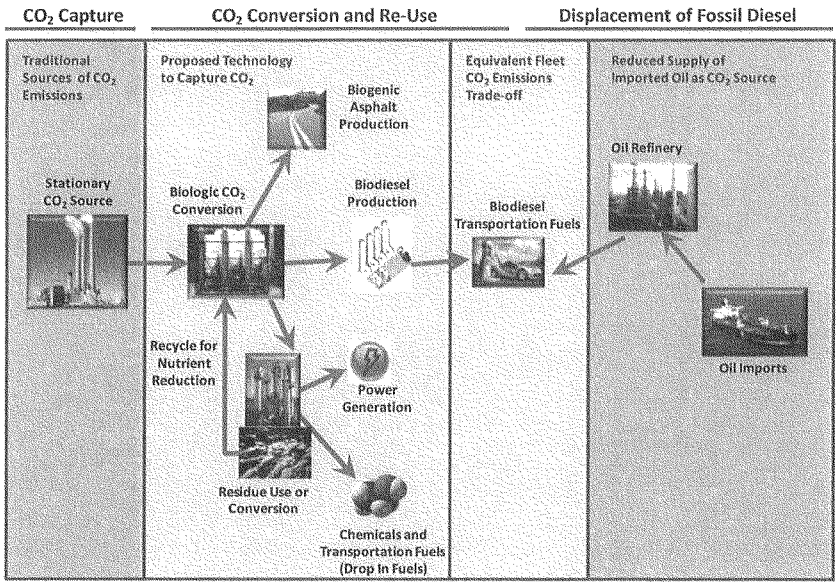

Figure B-1. CAT™ process schematic showing "Big Picture" global CO_2 reduction pathways.

The integrated societal energy system CO_2 reduction results when the synthetic diesel is used to displace conventional diesel consumption – achieving a second use of the carbon within coal prior to the eventual CO_2 emission from vehicle exhaust pipes. While the transportation sector CO_2 emissions are not directly reduced, the fact that the CAT biodiesel fuel prevented power plant CO_2 emission from entering the atmosphere we achieve an integrated societal system reduction in CO_2. A descriptive

formula comparison of Today (without CAT) and a Future (with CAT) illustrates the how an integrated societal energy system achieves lower net CO_2 emissions:

Today's Total CO_2 (without CAT) = Power Sector CO_2 + Transportation Sector CO_2 + Other CO_2 Emitters

Future Total CO_2 (with CAT) = Power Sector CO_2 lowered by 80% to 90% + Transportation Sector CO_2 + Other CO_2 Emitters

The CAT™ process uses chemoautotrophic bacteria (CAT bacteria) to capture and re-use carbon dioxide from flue gas, so these bacteria effectively recycle carbon that is likely from a fossil source for biodiesel production. To consume carbon dioxide from flue gas, the CAT bacteria get energy by oxidizing a reduced inorganic material. A synthetic symbiosis is then established to recycle the produced oxidized inorganic material, and this is accomplished by the use of reducing bacteria (RB). The RB consumes organic material while reducing the oxidized inorganic material. The organic material is derived from waste products from both the CAT™ process and other processes. A third type of bacteria is used to convert those waste products into organic material suitable for use by the RB (Figure B-2). RB and CAT bacteria will be harvested and further processed for biodiesel production.

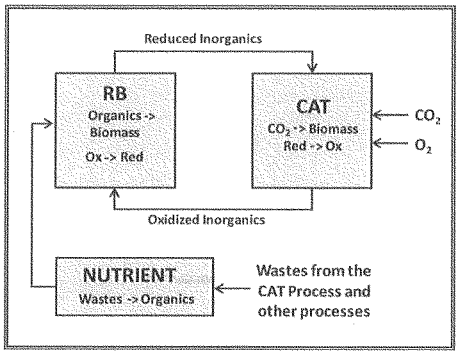

Figure B-2: Schematic of the CAT™ process.

Potential Applications. WRI has modeled the CAT™ process as an add-on to several existing technologies. The CAT™ process can be used to recycle CO_2 in various fuel emissions, such as those from coal, natural gas and biomass. This process is not limited to use with utilities but is applicable for a wide range of industrial CO_2 sources, such as cement and lime production, refineries, and others that use a fuel to produce heat and/or steam. Modeling results have shown the CAT™ process to produce approximately 53 gallons of biodiesel/ton of CO_2 captured. If the CAT™ process is used to capture carbon from a 100,000 ton of carbon dioxide per year emitter, we estimate that 5,329,930 gallons of biodiesel can be produced each year.

The CAT™ process can also be an economic driver for advanced coal-to-liquid technologies, such as gasification Fischer-Tropsch. Only 37% of the carbon entering the Fischer-Tropsch technology is converted to the liquid product, while 63% of that carbon is emitted as CO_2. If the CAT™ process is used to capture 75% of those carbon emissions for conversion to biodiesel, an additional 40% or more of the synthetic diesel could be produced. This completely changes the economics of the Fischer-Tropsch process to a more financially attractive investment.

Western Research Institute is investigating a wide range of applications for the CAT™ process in coal-based systems as well as non-coal applications.

Economics. Economic analysis performed at WRI was performed with an assumed biodiesel price of $3/gallon. Preliminary assessments of costs and revenue of a CAT™ process facility that captures 90,000 tons of carbon dioxide per year are listed in Table B-2. The calculated costs and revenues do not include potential income earned by selling carbon credits.

Table B-2. Predicted economics of the CAT™ process when deployed at a 100,000 ton of carbon dioxide per year emitter.

	Cost
Capital	$40.85M
Operation and Management	$7.6M/year
Revenue	$24.35M/year

Benefits. The CAT™ process has significant advantages over carbon capture and re-use technologies that rely on light, including many algal technologies. Table B-3 below summarizes these advantages. The independence from light of the CAT™ technology allows bacteria to be grown in deep, cylindrical reactors that can be partially buried. These reactors require significantly less capital than custom photobioreactors used by algae. In addition, the CAT™ technology uses 95-97% less land than open ponds of algae to produce the same amount of biodiesel. Since the reactors are in a closed system, unlike open ponds of algae, evaporative water losses are not an issue, which makes this technology more attractive in regions with limited water. We believe that these advantages would make this system an attractive carbon capture and re-use technology for existing stationary carbon dioxide emitters, especially power utilities and cement plants. Introduction of this biodiesel into the market would displace some of the petroleum diesel used, which in turn would slow the rate of carbon dioxide release into the atmosphere in an integrated national accounting approach.

Table B-3: Summary of benefits of the CAT™ process compared to algal technologies, particularly open ponds of algae.

	CAT™ Process	Algae
Productivities	On par with algae	On par with CAT
Reactor Type	Closed reactors, commercially available	Open raceway ponds, high surface area photobioreactors
Climatic Requirements	No particular requirements. Reactors may be insulated or buried to maintain temperature	Reduced performance in climatic extremes or locations with reduced sunlight. Reactors may require heating
Land Requirements	Relatively small footprint due to deep cylindrical reactors. A 95-98% reduction is estimated for larger CO_2 sources.	Large foot print, productivity maximized when reactors are no greater than 10-15 cm deep
Water Use	No evaporative losses	High evaporative losses

Next Steps. The CAT™ process is in the early research and development phase and has entered into the "valley of death" of the funding landscape. This technology is not brand new and thus is not eligible for many federal grants. However, since the technology is not yet at a pilot scale, industry is not as likely to be willing to invest in this stage of technology. While the Department of Energy ARPA-E program can provide funding opportunities for research and development activities through scale-up, these opportunities appear to only be available to technologies that were funded by ARPA-E at an early stage and focused on photobioconversion technologies. A funding mechanism for technologies, such as the CAT™ process, that are in this "valley of death" would accelerate the movement of promising technologies to the market.

References.

Bauer, C. *Energy Production and CO_2 Emissions: Protecting our Air Quality.* in *Air Quality VII, International Conference*. 2009. Arlington, VA.

EIA. 2009; Available from: www.eia.gov.

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ATTACHMENT C

Megatrend and Overarching Market and Economic Considerations

The following Megatrend, Market and Economic Conditions are used to focus WRI research on the challenges and opportunities.

Global economy will grow lead by emerging country economies and economic trading zones. It is reasonable to expect the economy in the Organisation for Economic Co-operation and Development (OECD) countries to experience modest real growth over the next three decades, including riding well through recessionary down periods. Energy consumption is often used as a measure of economic activity. The chart from the U.S. Department of Energy, Energy Information Administration (EIA) 2013 Energy Outlook Quick Look report shown in Figure C-1 illustrates the sharp decline in U.S. energy consumption associated with the economic decline following the 2008 Financial Crisis and the resulting Great Recession. The low gradual energy growth through 2040 reflects energy efficiency gains and relatively low U.S. growth forecast for the EIA Reference Case. The forecast is flat to negative for low economic condition scenarios.

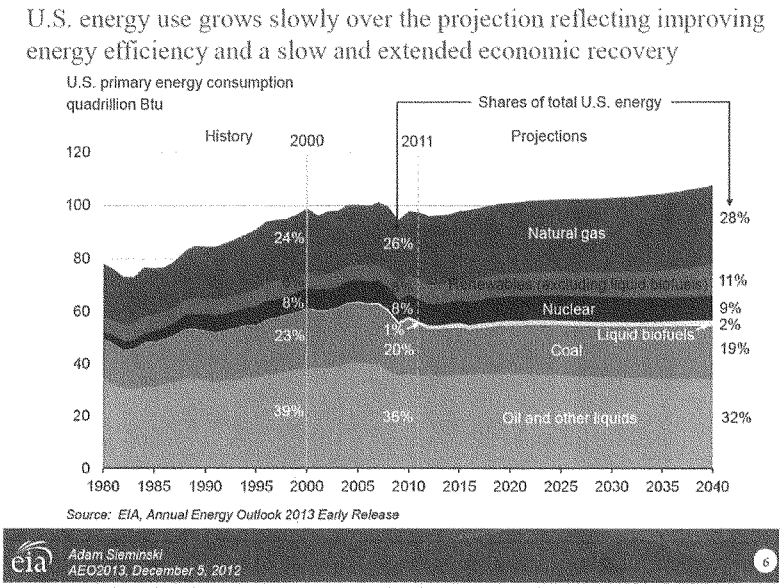

Figure C-1. U.S. DOE Energy 2013 Outlook Quick Look Energy Consumption

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Figure C-2 from the U.S. EIA and Figures C-3 and C-4 from the International Energy Agency (IEA) forecasts greater energy consumption increases for emerging economies compared to the OECD countries.

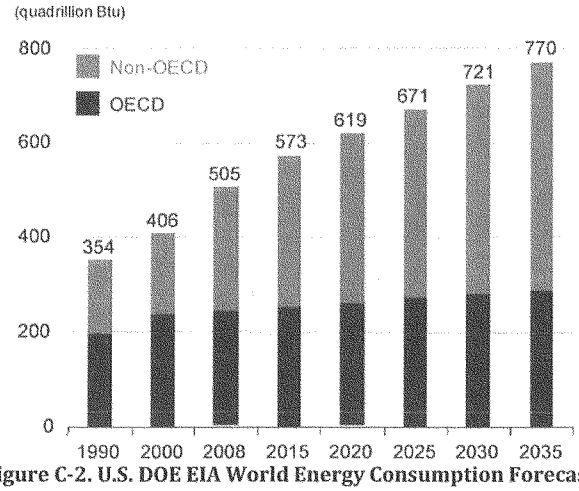


Figure C-2. U.S. DOE EIA World Energy Consumption Forecast

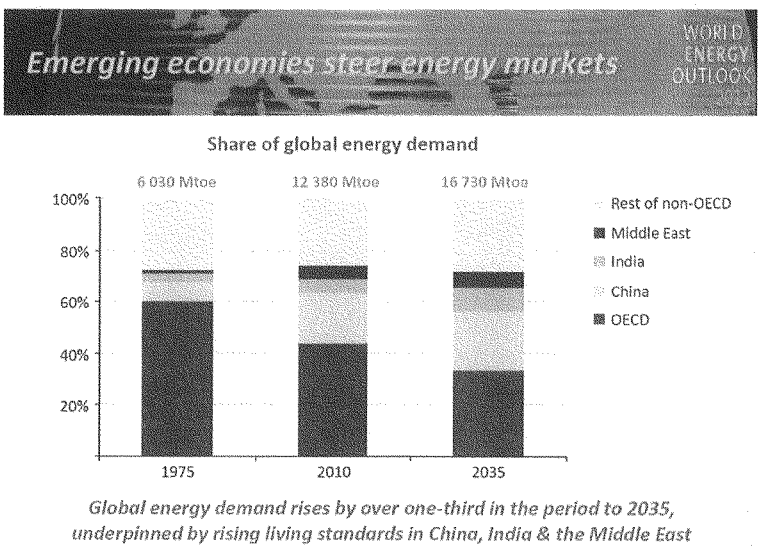


Figure C-3. International Energy Agency Global Energy Consumption Forecast

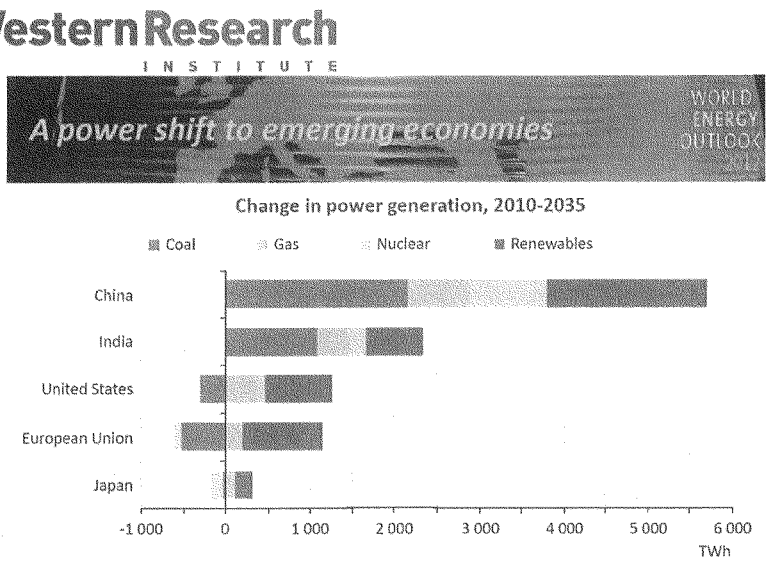
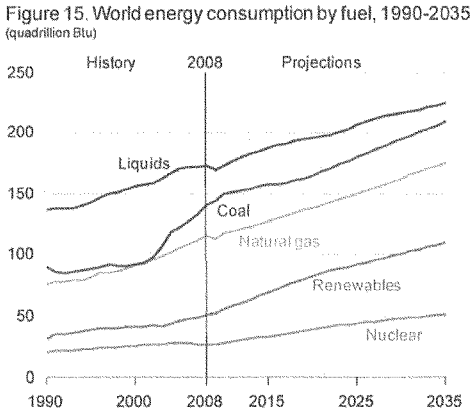


Figure C-4. International Energy Agency Global Electricity Generation Forecast

The U.S. DOE EIA global energy consumption forecast by various energy types illustrated in Figure C-5 highlights the megatrend demand for liquid energy fuels. This projection provides a clear picture and motivation to focus on recycle energy resource through multiple uses of carbon containing molecules in both fossil and biomass energy natural resources.



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ATTACHMENT D

WRITECoal™ Technology – An advanced Coal-based Technology to Enhance Coal Quality, Reduce Air and Water Emissions, Increase Plant Efficiency and Reduce Cost of Electricity

Western Research Institute (WRI) with the support of the U.S. Department of Energy, National Energy Technology Laboratory (USDOE, NETL), the states of Wyoming and the North Dakota and a wide range of utilities and industry organizations[2] have been developing a novel patented and patent-pending coal treatment/upgrading and multi-pollutant emissions control technology that increases efficiency and reduces the cost of electricity (COE) for both the existing fleet of coal-fired electricity generation units (EGUs) and new coal-fired EGUs, such as Integrated Gasification Combined Cycle (IGCC) and supercritical air-fired and oxy-fired plants.

The integration of the WRITECoal™ technology into an existing nominal 600MWe subcritical low-rank coal-fired power plant or new construction plant results several benefits. A previously untapped benefit is the ability to utilize the water delivered with low-rank coals to lower power plant consumption water from community water supplies. For example, subbituminous coal may supply 720 gallons of water per 1,000 tons of coal. This amounts to approximately 300,000,000 gallons for water in Wyoming coal production that has been untapped each year.

- Recovery of the water in low-rank (high water) coals evolved from the WRITECoal™ process for use at the power plant, requiring particulate removal only[3] - an untapped water-rich resource,
- The use of plant waste heat for drying increases energy efficiency,
- Increased plant power offsets parasitic power (important with future retrofit for carbon capture options),
- Reduction of emissions, such as mercury, NOx, SO_2, and CO_2 emissions on lbs/MWh basis, as well as on a percentage removal basis,
- Elimination of the need for a combustion or partial oxidation facility at an offsite or minemouth and associated cleanup of process streams, both gas and water,
- Elimination of the spontaneous combustion or dust/fines issues associated with transporting and storing thermodynamically unstable partially dried fuel, and
- Purchase coal from a variety of producers, not from a limited number of suppliers of a low-moisture, low-mercury processed coal at a higher price.

The following provides several examples of the retrofit integration of the WRITECoal™ process with subcritical air-fired and oxy-fired plants. In addition, the performance of integrating the WRITECoal™ process into a gasification/IGCC plant application is presented. There are other coal-fired applications, such as supercritical oxy-fired EGUs and new gasification Fischer Tropsch coal to liquids plants that are applicable, but not presented herein.

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[2] Includes State of Wyoming, State of North Dakota, North Dakota Industrial Commission/Lignite Research Council, Electric Power Research Institute, Basin Electric Power Cooperative, Detroit Edison, Montana-Dakota Utilities, Alliant Energy, Southern Company and SaskPower.

[3] Since the water recovered is free of regulated trace metals and organics and with conventional suspended solids removal, it can be used in the plant without further treatment.

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WRITECoal™ Process and Performance

The WRITECoal™ process is a patented and patent-pending two-step thermal coal upgrading and multi-pollutant emissions control methodology. In the first step, raw coal is heated to a temperature not exceeding 300 °F wherein the free water and most of the more tightly bound water is evaporated and removed. No evolution of mercury and other volatile metals (e.g., arsenic and selenium) occurs in this step allowing for water recovery without treatment for metal species removal. In the next step, the completely dried coal is heated to a temperature of 500-600 °F, wherein mercury in coal is volatilized and removed by an inert sweep gas. High temperature (500-600 ºF) sorbents, capable of capturing volatile metals, such as mercury and arsenic, have been developed to avoid the thermal energy efficiency loss resulting from cooling the sweep gas to 275 °F to enable conventional activated carbon sorbents to effectively capture the volatile metals. A relatively small sweep gas stream compared to plant exhaust stack gas flow is enabled by the WRITECoal™ process. This smaller volume of sweep gas creates higher volatile metals concentration that allows the sorbents to perform more efficiently compared to post-combustion emission capture in the large more dilute plant exhaust stack gas stream.

Coal Upgrading. For subbituminous coals, such as from the Powder River Basin (PRB), the WRITECoal™ process produces a coal that is low in moisture (<1.0%), low-sulfur (<0.6%), high heating value (11,000-11,500 Btu/lb), low in mercury and other volatile trace metals, such as arsenic and selenium (e.g., <0.03 ppmd mercury) and maintains a high volatile matter content and a high O_2 content compared to bituminous coal – important in integration of the process with oxy-combustion and gasification/IGCC systems.

Emission Reduction. When coupled with native capture with the fly ash and an oxidizer additive, the WRITECoal™ integrated retrofit process is estimated to achieve 87-92% mercury removal without the need for large volume post-combustion activated carbon injection (ACI)-based Hg control; and with pre-combustion physical separation technologies, such as air jig, mercury removal efficiency to consistently exceed 91%.

In addition, the WRITECoal™ product reduces NOx emissions by a dramatic 13% to 40% reduction in the flue gas. The impact of NOx emissions reduction on integration of the WRITECoal™ technology is significant from both a regulatory compliance and NOx credit perspective.

Table D-1. Characteristics of Typical Raw and WRITECoal™ Treated Low-Rank Coal.

Parameter	Wyoming PRB Coal		ND Lignite	
Proximate Analysis (wt%, as received)	**Raw**	**WRITECoal™ Product**	**Raw**	**WRITECoal™ Product**
Total Moisture	28.4	<1.0	36.55	<1.0
Ash	4.82	6.14	6.62	10.20
Volatile Matter	32.64	43.93	31.26	43.20
Fixed Carbon	34.14	48.93	25.57	45.60
Higher Heating Value (Btu/lb)	8,716	11,188	6,864	10,877
Mercury (ppmd)	0.126	0.025	0.184	0.083
Arsenic (ppmd)	4.2	1.4	10.4	6.5

Water Recovery. Another important benefit of the WRITECoal process is that it is possible to recover the water associated with the coal, typically 28-30% for PRB coals and 38-40+% for lignites found in states such a North Dakota and Texas. As mentioned the two-step WRITECoal™ process first removes water without volatile metals and other organic species, while the second step releases and captures the volatile metals from a relative low volume, dry sweep gas. The recovered water is clean with only suspended solids requiring filtration before being used within the plant. The water can supply the 50% to 60% of the boiler feed water makeup, or a portion of scrubber water or even a small fraction of the cooling water makeup water, thereby using less local water supply.

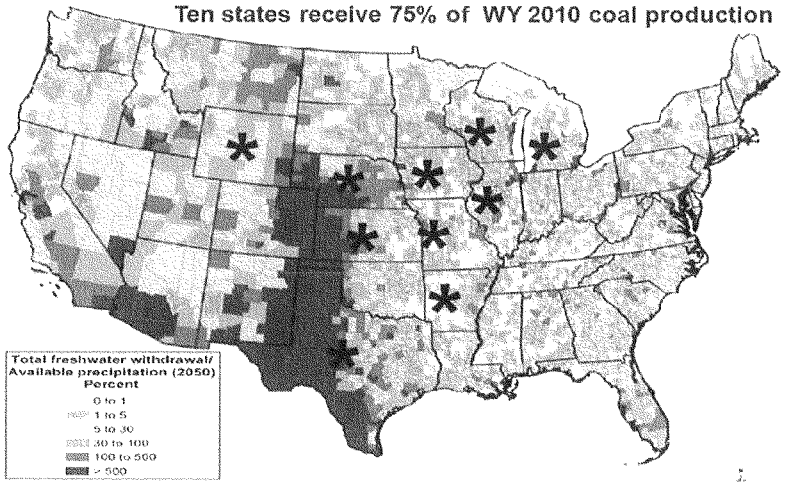

Figure D-1. National Resources Defense Council Map of US Showing the Areas of Drought Distress with Major Markets for PRB Coal Overlaid

Retrofitting Subcritical PC Coal Fleet with WRITECoal™ Technology

Retrofit Existing Fleet without Carbon Capture.

Efficiency. ASPEN Plus® modeling of the integrated WRITECoal™ retrofit based on a base case of 577MWe (net) PRB coal-fired plant and a 570MWe (net) lignite-fired plant with and without the WRITECoal™ process resulted in increased power output due to efficiency gains and the capacity to increase coal-firing. For example, it is possible to generate 34MWe (5.9%) of additional power by increasing coal feed by 4.4% for the PRB coal-fired plant and 30MWe (5.2%) additional power for a lignite plant with only a 2.2% increase in coal firing. The results showed a 3.4 to 3.6% increase in boiler efficiency gain up to 88.4% for the lignite and PRB cases with WRITECoal™ integration, translating to a 0.5 to 1.0 percentage increase in net plant efficiency. For example, a 1% increase in absolute net plant efficiency fleet-wide in coal-fired plants would result in about 60 million tons/year reduction in CO_2 emissions in the U.S.

Economics. Economic analysis (Jan 2009$) indicate that the Present Worth Revenue Requirements (PWRR) advantage for a WRITECoal™ retrofitted lignite plant was 26.3% and 11.7% compared with the same plant with activated carbon injection (ACI) and TOXECON, respectively for the lignite case and 8.2% for the PRB case compared to ACI deployed plant. The capital cost for a new subcritical 600MWe ND lignite-fired plant and PRB coal-fired plants without CO_2 capture and storage is estimated at $3,040/kWe and $2,870/kWe respectively. WRITECoal™ process total installed capital costs for the lignite-fired and PRB coal-fired subcritical plant translates into a cost of electricity (COE) advantage of 1.1 cents/kWh for the WRITECoal™ process compared to a new sub-critical lignite coal-fired plant COE of 6.7 cents/kWh.

Retrofit to Carbon Capture.

A second retrofit option is the conversion of an existing coal plant into an oxy-combustion plant with carbon capture. The conversion of the existing fleet to carbon capture results in a large increase in auxiliary power (parasitic) power and increases the cost of electricity by up to 80% with some carbon capture technologies. This results in a de-rating of the existing plant due to the fact that the plant does not have the capacity to simply increase coal throughput. As a result only options are to (1) take a major de-rating of the existing plant, (2) purchase power from a carbon capture plant to offset the parasitic power, or (3) install additional facilities like natural gas combined cycle plant to offset the parasitic power. Pilot-scale testing at 1 MWth-scale, modeling studies and costs and LCOE of an oxy-fired subcritical plant was conducted. Figure D-2 shows the mobile 1-2 MWth WRITECoal™ pilot plant integrated with a 1 MWth oxy-combustion pilot plant at Southern Research Institute.

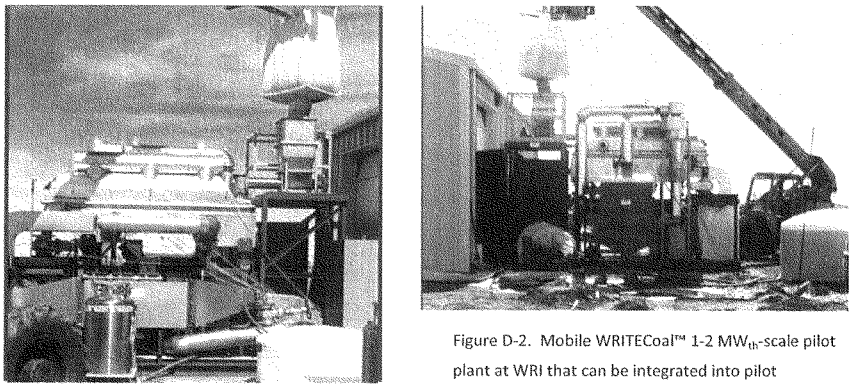

Figure D-2. Mobile WRITECoal™ 1-2 MW_{th}-scale pilot plant at WRI that can be integrated into pilot combustion system

Efficiency and Levelized Cost of Electricity (LCOE). Efficiency modeling and LCOE of such as oxy-combustion retrofit are shown in Table D-3 and indicate that the purchasing of power does not increase efficiency and increases the COE from 6.8 cents/kWh for the raw coal case. However, the installation of high-efficiency Natural Gas Combined Cycle (NGCC) to cover the parasitic power associated with carbon capture increase efficiency by 4.85% and reduces the LCOE to 5.8cents/kWh from the base of 6.8 cents/kWh. This is a major increase in efficiency and more importantly a major reduction in the cost of electricity when deploying carbon capture to the existing fleet of coal-fired subcritical plants.

The 5.8 cents/kWh for the WRITECoal oxy-combustion with high-efficiency NGCC has equivalent LCOE of a new subcritical plant without carbon capture.

Table D-3. Summary of the Efficiency and Costs for Retrofit of Existing Subcritical Coal-fired Unit to Oxy-combustion with Carbon Capture.

	PRB Oxy-Fired with CO_2 Capture Retrofit		
Costs Jan. 2012 $	**Case 1 Base Raw**	**Case 3 W-Coal w/ Purchase Power**	**Case 4 W-Coal w/ NGCC**
Performance			
CO_2 Capture, %	90	90*	83*
Gross Power-Coal, MWe	590.0	590.0	641.5
Gross Power-NG, MWe		191.2	149.3
Net Power, MWe	401.0	401.0	592.0
Efficiency Gains over Base %	0.0	0.0	4.85
Costs			
TCR [1], 1000$	1,110	1,110	1,420
$/kW	2,800	2,800	2,400
Fixed O&M, 1000$	24.80	24.80	32.20
Var. O&M, 1000$[4]	69.70	125.30	86.53
Total O&M, 1000$	94.50	150.10	118.80
PWRR, 1000$	1,870	2,560	2,360
LCOE, cents/kWh	**6.8**	**9.3**	**5.8**

*Assumes purchased power is from 90% CO_2 capture EGU.

WRITECoal™ Gasification/IGCC Technology New Plant Application

WRITECoal™ Gasification /IGCC. The WRITECoal™ process can also provide the industry with an economical method of environmental compliance for new plants such as IGCC using low-rank lignite and subbituminous coals, termed WRI's **"WRITECoal™ Gasification/IGCC"** technology. This patent-pending integrated technology not only improves gasifier efficiency, but also features CO_2 recycle to generate additional CO feed to the water-gas-shift reactor thereby producing additional H_2 for power generation and/or chemical production.

The WRITECoal™ gasification/IGCC technology is based on three advantages/benefits of the integrated system; (1) the reduction of moisture (to near zero percentage by weight) in the WRITECoal™ product to the gasifier results in

lower gasifier size (capital costs); (2) control of the oxidation of carbon to CO results in enhanced volume of hydrogen in syngas to the gas turbines, allowing reduced fuel feed for the same gas/steam turbine output; and (3) the WRITECoal™ process uses as much waste heat as possible and maximizes gas turbine power. The net result of these three features is a reduction in gasifier capital from a reduction in size and parasitic load from the Air Separation Unit (ASU) and increased power output from the integrated system per unit of coal feed.

The WRITECoal™ integrated gasification/IGCC generates a higher $CO+H_2$ syngas of >82% and a lower CO_2 content (~5.1%) especially advantageous for chemical production, such as H_2 production. Cold gas efficiency, a measure of the efficiency of the gasifier, is increased by 5% with the addition of WRITECoal™. The high CO and low CO_2 reflect the higher efficiency of gasification with the treated coal and the lower consumption of oxygen (Bland et al., 2012). The WRITECoal™ gasification/IGCC process can be deployed with nearly all of the commercially available gasification systems and positively impact the efficiency and ultimately the COE which varies with gasifier and IGCC subsystem selection.

Efficiency and LCOE. A summary of the performance and Levelized Cost of Electricity (LCOE) of WRITECoal™/IGCC for power production using three different gasifiers is presented in Table D-4. The data establishes that 3.28 to 4.81% efficiency increases with the three gasifiers as a result of the integration of the WRITECoal™ gasification, including moisture removal/coal upgrading and the recycle of CO_2 to the gasifier compared to the raw coal case without CO_2 recycle.

Table D-4. Summary of the Efficiency and Cost of Electricity of WRITECoal™ Gasification Scenarios

Parameter	High Temperature Gasifier			Transport Gasifier			Fluidized Bed Gasifier		
	Raw PRB	Partially Dry 6%	W-Coal™	Raw PRB	Partially Dry 18%	W-Coal™	Raw PRB	Partially Dry 20%	W-Coal™
Operating Performance									
Fuel Moisture Content, %	28.35	6.00	0.00	28.35	18.00	0.00	28.35	20.00	0.00
CO_2 Recycle to Gasifier	No	No	Yes	No	No	Yes	No	No	Yes
TOTAL POWER, MWe	589.8	585.7	607.9	645.8	610.1	639.4	605.3	590.4	610.8
Net Power, MWe	371.1	386.8	411.1	468.4	442.6	502.4	430.0	125.1	452.5
Efficiency Increase, %	0.00	2.26	**4.33**	0.00	0.0	**4.81**	0.0	0.10	**3.28**
Costs									
TCR, $/kW	5,900	5,700	5,300	4,100	4,200	3,500	4,400	4,400	4,100
Capital Costs, mills/kWh	115.00	104.49	**97.58**	41.17	42.10	**35.92**	50.07	49.91	**46.17**
Fixed O&M, mills/kWh	36.35	32.61	30.58	33.49	34.76	29.65	48.19	47.01	49.57
Variable O&M, mills/kWh	20.70	18.93	17.62	17.56	17.55	15.29	19.92	19.76	17.73
Total LCOE, cents/kWh	**17.2**	**15.3**	**14.2**	**9.2**	**9.4**	**8.1**	**11.5**	**11.7**	**11.4**

LCOE – Levelized Cost of Electricity

This corresponds to a lowering of LCOE from 17.2 to 14.2 cents/kWh for the high temperature gasifier, to 11.5 to 11.4 cents/kWh for a fluidized bed gasifier and from 9.2 cents/kWh to 8.1 cents/kWh for the transport gasifier. Part of the difference between the transport gasifier and the fluidized bed gasifier is a result of the higher operating pressure for the transport gasifier.

Conclusions and Next Steps

It has been demonstrated that the benefits of the WRITECoal™ process on retrofit and new EGUs are:

- Applicable to all low-ranks coals: Powder River Basin subbituminous and Gulf Coast and North Dakota lignites.
- In combustion systems, the WRITECoal™ upgrading technology results a 3-5 % increase in boiler efficiency and a 1-3% increase in net efficiency. A 1% increase in efficiency fleet wide in the U.S. results in 60 million tons of CO_2 emission reduction per year.
- In gasification systems, the integrated WRITECoal™ technology results in 3-5% increase in IGCC cycle efficiency.
- The WRITECoal™ multi-pollutant technology when integrated into an existing subcritical plant results in gaseous emissions reductions (e.g., NOx reductions of up to 40%) and volatile metals reductions (e.g., mercury reductions of 87-92%, arsenic of ~40%-60%, and selenium of ~25%),
- The water in the coal can be recovered and used in the plant, thereby reducing freshwater consumption[4],
- The WRITECoal™ process deployed at the power plant uses waste heat to a large degree, lowering WRITECoal™ energy costs, and
- In both retrofit of the existing fleet and construction of new coal-fired EGUs, the WRITECoal™ integration results in a lower levelized cost of electricity (LCOE), especially when 80-90% carbon capture is required.

As such, the WRITECoal™ process represents one of several important advancements/improvements in gasification for both power generation and chemical production and should be considered as one of the potential enabling technologies that will allow the industry to continue to provide the ratepayers with low-cost, low-greenhouse gas emissions coal-based electrical power. A significant component/process step is that it improves efficiency and costs of retrofitted subcritical air-fired and oxy-fired pulverized coal plants, as well as new IGCC plants each of which may be required to deploy carbon capture in the near future.

As such, WRI has demonstrated that the application pathways for the WRITECoal™- exist for both environmental and COE benefits for existing and new coal-fired plants to the benefit of the industry and the rate payers. The hereto successful research and demonstration results still requires additional support from federal and state governments and industry partners for accelerated large-scale demonstration and deployment of the technology.

Expanding on WRI's WRITECoal™ technology for application as a retrofit to existing plants, a larger-scale utility slipstream demonstration using coal-fired flue gas heating media should be pursued with PRB coal-fired utilities and cogeneration facilities. Specifically, the following recommendations are made.

- A 5 MW_{th} demonstration of the WRITECoal™ gasification/IGCC technology, such as at GTI's U-GAS Flex Fuel facility, is needed to further define and validate the commercial deployment opportunities and cost benefits, or alternatively a5 MW_{th} slipstream unit can be designed and operated at a commercial coal-fired utility site. This scale needs the financial support of the Federal government, State government and coal industry organizations as well as individual utilities.
- And lastly, it is imperative that for advanced coal technologies, such as WRI's WRITECoal™ technology, to be deployed that such deployment not result in New Source Review.

[4] Since the water recovered is free of regulated trace metals and organics and with conventional suspended solids removal, it can be used in the plant without further treatment.

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ATTACHMENT E

In-situ Enhanced Biogenic Methane Production for Increased Coal-Based Gas Production Efficiency

WRI has developed an advanced system for in-situ enhanced biogenic methane production from coal using naturally occurring microorganisms that normally live in coal. This technology extends the life of current coal bed methane wells and allows the revitalization of abandoned, unproductive wells. Additionally, this technology can be used to produce methane from low-rank coal deposits and deposits beyond the reach of financially viable mining. Overall, the enhanced biogenic methane industry is involved in pilot demonstrations internationally but struggling within the United States due to a lack of clear regulations for this industry. Research regarding the environmental impacts, including affects on environmental quality and quality of produced methane, of this technology needs to be completed so appropriate regulations and monitoring practices can be established.

Coal Treatment. The activity of the naturally occurring, methane-producing microbes present in coal can be enhanced in multiple ways. First, coal can be treated to make it a more accessible food source for the microbes, and thus the microbes will produce methane at a faster rate than without the treatment. WRI has data (Figure E-1) showing that this treatment affects the structure of the coal and breaks large carbon compounds into smaller, more easily accessible carbon for the microbes to consume. The smaller compounds, circled in panel B of Figure E-1, are clearly present only after the treatment of coal. It is worth noting that once coal is treated, the treatment does not "spread" beyond the treatment zone. If additional enhanced biogenic methane production is desired, then the in-situ coal conversion zone must be treated again. At this time, it is unknown how the treatment of coal affects metals, such as mercury, that can be trapped within the structure of the coal. Research to understand the effects of coal treatment on potential reduction/avoidance of environmental hazards, such as mercury, arsenic, and other metals, is an essential research area for the establishment of regulations for the enhanced biogenic methane industry.

Nutrient Addition. Nutrients can also be added to stimulate the naturally occurring microbes to consume more coal thereby producing more methane. These nutrients could be found in common food products. WRI has found that addition of nutrients to the naturally occurring microbes in coal can stimulate methane production, but it is a combination of the treatment of coal and addition of nutrients that provides the greatest stimulation of methane production (Figure E-2). When coal is treated and nutrients are added, approximately 20 times more methane was produced in the same amount of time as compared to untreated coal with no added nutrients. Work done by WRI and others has shown that coal can be treated and nutrients added multiple times, and methane production is enhanced with each round of treatment and nutrient addition. The public may be concerned over the release of nutrients into the environment and potentially the water supply. Research regarding the effect of these nutrients on the environment needs to be conducted to understand if then what appropriate level of environmental control and monitoring should be applied.

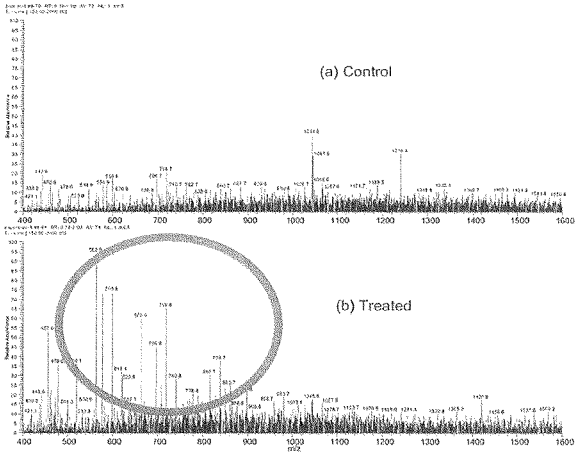


Figure E-1: Negative Ion Electrospray Ionization Mass Spectra of (a) Control and (b) Treated Water-Soluble Fraction in Coal Samples

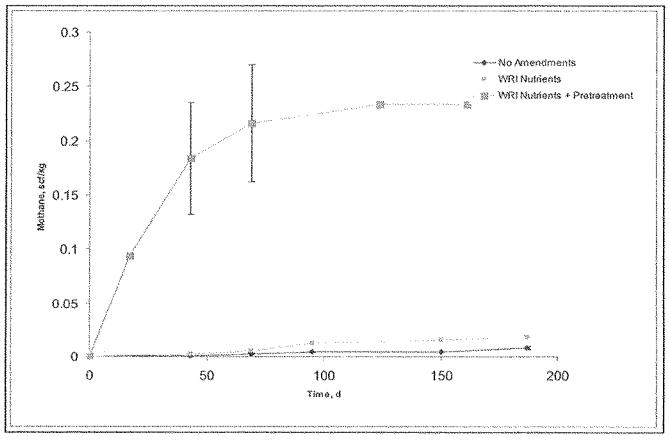


Figure E-2: Methane production was compared from untreated coal, untreated coal with added nutrients, and treated coal with added nutrients. Treatment with nutrients approximately doubled the amount of methane produced when compared to untreated coal with no nutrients. When coal was treated and nutrients were provided, the amount of methane produced was approximately 10 times greater than the amount produced when coal was only treated with nutrients.

Test Sites. United States-based enhanced biogenic methane companies are performing pilot demonstrations of this technology in other countries. A summary of enhanced biogenic methane projects are below, organized by company:

Western Research Institute (WRI). WRI, located in Laramie, Wyoming, partnered with Regal Resources Ltd. of Australia to operate at a pilot scale WRI's enhanced biogenic methane technology [1] . Pictured below in Figure E-3 is WRI's technology deployed at a pilot scale in Australia.

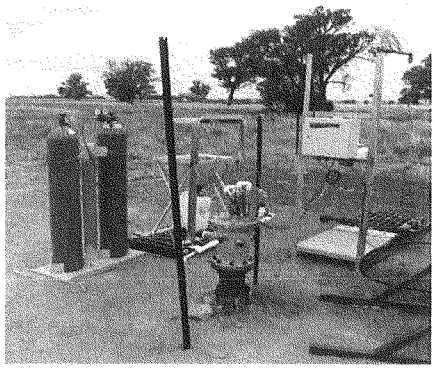


Figure E-3: WRI's pilot scale enhanced biogenic methane technology in Australia.

Ciris Energy. Ciris Energy of Centennial, Colorado has a 160 acre test site and other leases in Wyoming [2]. Ciris Energy has also partnered with Regal Resources Ltd. of Australia for enhanced biogenic methane production in Australia [3]. Recently Ciris Energy announced that it received approximately $25 million from an undisclosed Hong Kong investor for international expansion [3], presumably in Asia.

Luca Technologies. Wyoming was a primary target location for Luca Technologies, located in Golden, Colorado, but the company is now pursuing other locations for their pilot demonstrations after permitting problems in Wyoming.

Next Fuel, Inc. Next Fuel, Inc. located in Sheridan, WY has announced that they are "working on strategic partnership with Australian energy companies to commercialize" their enhanced biogenic methane technology, that they have a pilot scale demonstration in China, and that they have initiated field projects in Indonesia [4]. Next Fuel, Inc. also announced that they "are discussing with a few Canadian resource owners about establishing partnership to commercialize" their enhanced biogenic methane technogy [4]. In 2013, Next Fuel, Inc. announced that it had signed an agreement to conduct a pilot scale project with Vistat Oil-tech Private Ltd. in Gujarat, India [5].

Next Steps: Regulatory issues related to enhanced biogenic methane production in the United States need to be resolved to allow for industry growth and energy production using this technology. To

develop meaningful regulations, reliable answers from research are needed. Some research needs to be addressed when developing regulations for this industry include:

- Demonstrations are needed to verify the environmental impacts of this technology are needed to develop reasonable regulations for the enhanced biogenic methane technology. This includes monitoring of water quality, determination of the needed amount and location of monitoring wells, and monitoring of the surrounding coal to verify that this technology does not degrade the quality of that coal for mining.
- The regulatory agency that regulates the enhanced biogenic methane industry needs to be determined, since it is currently unclear whether it should be regulated with coal and natural gas or if it should be regulated by an environmental agency.
- The United States should examine regulations for enhanced biogenic methane production in countries that are using this technology.
- The owner of the mineral rights to methane produced from coal needs to be established. It is currently unclear if the person/entity that owns the mineral rights for the coal also owns the right for the in-situ methane produced from that coal or if it is a different mineral right since the resource being collected is methane.

References:

1. Fugleberg, J., *Wyoming researchers license new methane process*, in *Casper Star Tribune*. 2011: Casper.
2. *Ciris Forms Wholly Owned Australian Subsidiary*. 2012 [cited 2013 July 16]; Available from: http://cirisenergy.com/news/announcements/ciris-forms-wholly-owned-australian-subsidiary/.
3. Herndon, A. *Hong Kong Investor Backs Ciris's Microbial Coal-to-Gas Process*. 2013 [cited 2013 July 16]; Available from: http://www.businessweek.com/news/2013-02-28/hong-kong-investor-backs-ciris-s-microbial-coal-to-gas-process.
4. *Next Fuel, Inc: Global Reach*. 2013 [cited 2013 July 16]; Available from: http://www.next-fuel.com/worldwide.
5. *Next Fuel Inc Signs Agreement To Conduct Coal-to-Gas Operations In India*. July 17, 2013; December 20, 2012:[Available from: http://www.reuters.com/finance/stocks/NXFI.PK/key-developments/article/2663850.

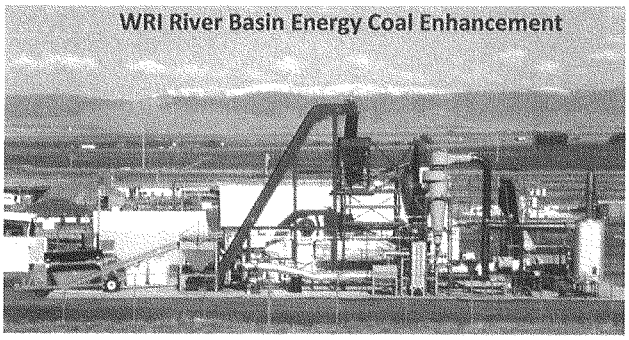
Western Research
INSTITUTE

ATTACHMENT F

Coal Dryer Energy Enhancer: Delivering Cleaner, Higher Energy, Lower Emission Low-Rank Coal

Benefits:

- ✓ Upgrades PRB coal energy value from 8,000 to 10,500-11,000 Btu/lb
- ✓ Removes ~85% of mercury and 40-60% of arsenic and selenium delivering a cleaner coal
- ✓ Low mercury coal lessens mercury capture retrofit and operational expense
- ✓ Clean Wyoming coal export lowers emissions in other countries that don't install emission controls. **Note:** More mercury lands in the U.S. each year from foreign country sources.
- ✓ Export sale enables achieving U.S. domestic mercury reduction policy goals.
- ✓ Inherently stable against spontaneous combustion without need for coating
- ✓ Increases sale price of low-rank coal ($9-11/ton) comparable to eastern coals: $30 - 50/ton
- ✓ Energy-Water Nexus: Produced water is non-toxic and is usable for Clean Air Act dust suppression at mine sites



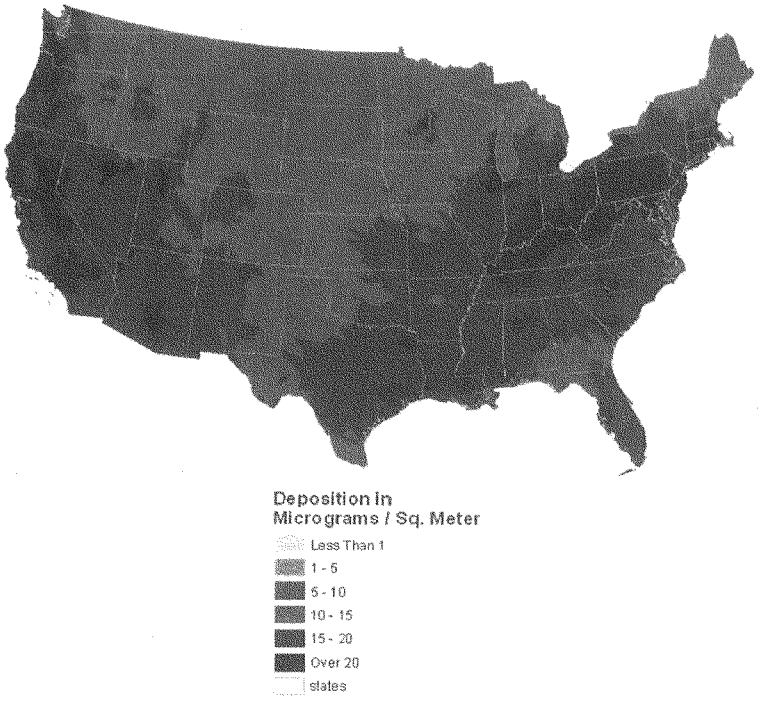
Summary:

- WRI successfully developed a coal upgrading technology which increases marketability and environmental performance of low rank coals.
- The technology increases heating value, reduces moisture content, and reduces mercury, arsenic and sulfur constituents to allow for large scale use by coal consumers.
- Successfully designed and operated a patented process for coal upgrading, at a scale of ~100 tons/day, delivering a value-enhanced cleaner coal for power and heat generation.
- Reduces carbon footprint and other emissions while increasing energy efficiencies.
- Technology addresses energy-water nexus as the water discharge is clean and usable as-is for dust management to meet Clean Air Act dust management requirements.

Next Steps: Plans are under development to deploy the technology in Gillette, Campbell County, Wyoming. This first commercial plant for upgrading the energy (Btu) value of low rank

coal will remove 85% of the mercury from PRB coal will deliver the cleanest coal available in the world. The project is expected to create 20 jobs during the construction phase and 30 jobs during operations of the first plant. The project is expected to bring up to $50 million to the State of Wyoming during construction and job wages of $2.3 million per year during operations.

The figure below illustrates the high mercury areas within the U.S. High levels exist in the west coast states. The source for the figure is from the U.S. EPA 2005 Community Multiscale Air Quality Model. Presently, a large percentage of mercury depositing in the west coast states is attributable to coal burning power plants in China. The amount of mercury depositing in these states is expected to increase over the next few decades due in large part to predicted large growth in coal burning plants in China. The Wyoming technology described above provides a means to remove nearly all mercury from Wyoming coal that is exported to Asian markets, including China. This provides an U.S. developed technological solution to protect western states from growth in future mercury deposits while dealing with the practical reality of environmental policies in China and other Asian countries – a win for Wyoming and a win for California.



Don Collins

Don Collins is the Chief Executive Officer of Western Research Institute located in Laramie, Wyoming. He and his team focus on transitioning scientific and applied research into technologies for clean zero-emission energy, environmental emissions capture, in-situ environmental remediation, water conservation and reuse, and lower cost methods for building highways.

He has 29-years of experience in engineering and management of research, design, and deployment of new technologies.

Prior to arriving at WRI, Don managed groups of scientific and engineering project managers in pursuit of the U.S. Department of Energy Clean Coal Technology RDD&D goals. For about 6.5-years he managed DOE RDD&D programs focused on fuel cells and energy storage technology for distributed and central power applications, including smart grid technologies. In this role, he was responsible for hydrogen turbines and high efficient CO_2 compressor development under the DOE's FutureGen and Carbon Sequestration programs.

Don's first 17-years were dedicated to submarine technologies and integration of complex systems for SEAWOLF and VIRGINIA Class submarines, for the U.S. Navy, including CO2 scrubber technology.

Chairman LUMMIS. Thank you, Mr. Collins.

And now I recognize Ms. Greenwald to present her testimony. Good morning.

TESTIMONY OF MS. JUDI GREENWALD, VICE PRESIDENT, CENTER FOR CLIMATE AND ENERGY SOLUTIONS

Ms. GREENWALD. Thank you. Madam Chairman, Congressman Swalwell, and Members of the Subcommittee, thank you for the opportunity to testify, and thank you, Congressman Veasey, for that kind introduction.

My name is Judi Greenwald, and I am the Vice President for Technology and Innovation at the Center for Climate and Energy Solutions. My testimony today will focus on the most important climate and energy solution that no one knows about. I will emphasize two main points.

First, carbon capture and storage, or CCS, is a critical technology for addressing climate change while allowing continued reliance on fossil fuels. Second, carbon dioxide-enhanced oil recovery, or CO_2 EOR, can advance CCS while boosting domestic oil production and creating and generating that Federal revenue.

The United States and the rest of the world get 80 percent of our energy from coal, oil and gas, and our fossil fuel dependence is expected to continue for the foreseeable future. Carbon dioxide emissions from burning these fuels pose an enormous challenge. That is why we need CCS, a suite of technologies that capture CO_2 and stores it deep underground in geological formations. CCS can capture up to 90 percent of emissions from power plant and industrial facilities, allowing coal and natural gas to remain part of our energy mix. CCS has been commercialized for certain industrial processes. However, CCS in other contexts, for example, coal and natural gas power plants is a relatively expensive technology that is just reaching maturity. The key challenge for CCS is to get a sufficient number of commercial-scale projects up and running to demonstrate the emerging technologies at scale and bring down their costs.

The Department of Energy's role in CCS development has been and will remain critical. DOE is working with the private sector on the leading innovative CCS projects today including several coal-based power projects. Additional drivers will be needed, though, to help the next generation of CCS projects move forward. That is why CCS is being increasingly thought of as carbon capture utilization and storage, or CCUS.

Utilizing captured carbon dioxide for enhanced oil recovery, or CO_2 EOR, could play a key role in the development of CCS. It also has the potential to increase American oil production by tens of billions of barrels while displacing imported oil and safely storing billions of tons of carbon emissions underground.

Let me explain how this works. Even after conventional primary and secondary oil recovery, most of the oil in a typical field is left in the ground. Injecting carbon dioxide deep underground can make it possible to recover more oil and extend the field's life. The United States has been a global leader in CO_2 EOR for 40 years, and gets six percent of its domestic oil this way. While most CO_2 EOR activities occur in the Permian Basin of Texas, there are also

projects in Wyoming, the Gulf Coast, Oklahoma and Michigan. Using existing technologies, CO_2 EOR could double or triple U.S. reserves. It could also store 10 to 20 billion tons of carbon dioxide, equivalent to five to ten years. worth of emissions from all U.S. coal-fired power plants. More advanced technologies could yield much higher production and CO_2 storage.

Right now, most enhanced oil recovery is done using carbon dioxide that is already underground and that is ironically in short supply. By using captured manmade carbon dioxide, we can increase domestic oil production, promote economic development, create jobs, reduce carbon emissions, and drive innovation in CCS technology. Because of these multiple benefits, we have been able to bring together the National Enhanced Oil Recovery Initiative, or NEORI, a diverse coalition of industry, labor and environmental organization, and state officials. This coalition's consensus recommendations call for a Federal tax incentive to capture manmade CO_2 for EOR.

In some regions, EOR operators are willing to pay upwards of $30 per ton for CO_2. At the same time, industrial facilities and power plants are emitting billions of tons of CO_2 into the atmosphere as a waste. CO_2 EOR offers the opportunity to transform this waste into a marketable commodity and transform an environmental problem into an energy production solution. By combining private EOR operators willing to pay for CO_2 with a tax incentive, society would leverage its public investment. Tax incentives for carbon dioxide-enhanced oil recovery would more than pay for themselves within ten years by increasing domestic oil production and associated taxable oil revenues. Federal revenue would exceed the fiscal cost of new incentives by more than $100 billion over 40 years.

To summarize, CCS is a critical technology for reconciling our continued dependence on fossil fuels with the imperative to protect the global climate. Our best hope at the moment for advancing CCS is carbon capture utilization and storage, or CCUS, and the best current example of that is enhanced oil recovery. Solving our climate and energy problems will require a portfolio of technologies, and all must be pursued vigorously. But we are focusing here today on CO_2 EOR because it is the most important climate and energy solution that no one knows about.

Thank you for your attention. I look forward to your questions and to working with the Subcommittee and the Congress to advance this critical technology.

[The prepared statement of Ms. Greenwald follows:]

Testimony of

Judi Greenwald
Vice President for Technology and Innovation
Center for Climate and Energy Solutions

before the

Subcommittee on Energy
Committee on Science, Space, and Technology
U.S. House of Representatives

Hearing on The Future of Coal: Utilizing America's Abundant Energy Resources

July 25, 2013

Carbon Capture, Utilization and Storage

Madam Chairman, Rep. Swalwell, and members of the Subcommittee, thank you for the opportunity to testify on carbon capture, utilization, and storage. My name is Judi Greenwald, and I am Vice President for Technology and Innovation at the Center for Climate and Energy Solutions (C2ES – formerly known as the Pew Center on Global Climate Change).

My testimony today will focus on the most important climate and energy solution that no one knows about. I will emphasize two main points:

- Carbon capture and storage (CCS) is a critical technology for solving climate change, while allowing continued reliance on fossil fuels.
- Carbon dioxide enhanced oil recovery (CO_2-EOR) can advance CCS, while boosting domestic oil production and generating net federal revenue.

C2ES is an independent, nonprofit, nonpartisan organization dedicated to advancing practical and effective policies and actions to address our global climate change and energy challenges. We perform multifaceted research and analysis of the scientific, technological, economic, and policy aspects of these issues. Our work is informed by our Business Environmental Leadership Council (BELC), a group of 34 major companies, most in the Fortune 500, that work with C2ES on climate change and energy risks, challenges, and solutions. The views I am expressing, however, are those of C2ES alone.

C2ES has been analyzing CCS for over a decade and has recently focused on how CO_2-EOR can advance CCS. With the Great Plains Institute, C2ES co-convenes the National Enhanced Oil Recovery Initiative, or NEORI, a coalition of businesses, environmental NGOs, labor representatives, and state officials advocating for incentives to use captured CO_2 in EOR. You

can find more information on NEORI at www.neori.org. I would like to submit NEORI's CO_2-EOR analysis and consensus recommendations for the record. In addition, C2ES serves as the advisor and facilitator to the Sequestration Working Group of the North America 2050 Initiative, a collaborative of states and provinces exploring options for CCS regulations and incentives. C2ES recently completed a summary of state-level regulations and incentives that can be found at www.na2050.org/sequestration.[1]

C2ES also has authored research and publications related to CCS and CO_2-EOR. For example, C2ES developed a comprehensive framework for calculating CO_2 emissions from CCS based on input from experts in industry, academia, and the environmental community.[2] C2ES also publishes a CCS Climate TechBook,[3] a brief report that explains in layman's terms how CCS technology works, why its development is needed to address climate change, and how it might be advanced.

CCS is a critically important technology

The United States and the rest of the world are getting 80 percent of our energy from coal, oil and gas, and our dependence on, and overall use of, these fossil fuels globally is growing rapidly. Under a business-as-usual scenario, the Energy Information Administration expects fossil fuels will continue to provide more than 65 percent of U.S. electricity in 2040 – with 35 percent coming from coal-fired generation. Globally, coal consumption is expected to increase nearly 60 percent over the next two decades, led by developing countries like China and India, which together will comprise 62 percent of the total global coal demand in 2035. This poses an enormous challenge, because the CO_2 emissions from the combustion of these fossil fuels are the major contributor to global climate change. While we can and should become more energy-efficient and shift our energy mix toward inherently zero-emitting sources like nuclear power and renewables, it will be difficult to do that fast enough and at a reasonable enough cost to avoid the worst climate impacts.

Hence the critical need for CCS, a suite of technologies that captures CO_2 and stores it deep underground in geological formations. CCS can capture up to 90 percent of emissions from stationary sources, such as power plants and industrial facilities, thereby allowing coal and natural gas to remain part of our energy mix. The International Energy Agency (IEA) and others have demonstrated through detailed technology and economic scenario analyses that CCS is likely an essential component of an affordable and effective response to global climate change. In fact, IEA estimates that CCS could provide one-sixth of the requisite GHG emissions reductions by 2050.

What is needed to advance CCS?

CCS has been established and commercialized for the capture of CO_2 from some industrial processes such as natural gas processing, chemical, fertilizer and ethanol production, and the

[1] http://na2050.org/wp-content/uploads/2013/07/NA2050_State_Policy_Actions_to_Overcome_Barriers_to_CCS_and_CO2-EOR.pdf
[2] http://www.c2es.org/publications/greenhouse-gas-accounting-framework-carbon-capture-and-storage-projects
[3] http://www.c2es.org/technology/factsheet/CCS

gasification of coal. The use of man-made CO_2 in EOR has been practiced for several decades. However, CCS in other contexts – for example, coal- and natural gas-powered electricity generation – is a relatively expensive technology that is just reaching maturity. Further R&D is important, but the key challenge for CCS is to get a sufficient number of commercial-scale projects up and running to demonstrate the emerging technologies at scale and bring down their costs. The first large-scale commercial CCS power projects are under construction. Yet, it is still unclear whether more commercial-scale CCS projects will be built after these initial projects are completed. After the collapse of climate legislation in the United States in 2010, a number of CCS projects were cancelled.

CCS is being increasingly thought of as carbon capture utilization and storage, or CCUS. Instead of seeing CO_2 as a waste, utilizing and selling captured CO_2, primarily for EOR, improves the economics of CCS projects and is an important market driver. Almost all of the existing or planned CO_2 capture projects in the United States have been developed with the intention of marketing captured CO_2 for use in EOR. Still, in many cases, additional drivers are needed. Those projects operating or underway today are being financed though some combination of U.S. Department of Energy (DOE) grants, utility cost recovery from ratepayers, private finance, sales of CO_2 for EOR, other revenue streams from chemical production, and existing tax credits.

DOE's role in CCS development has been and will remain critical. DOE is working with the private sector on the leading innovative CCS projects in the United States today. This collaboration is beginning to yield results. In late 2012, the DOE-supported Air Products' Port Arthur CCS project, where CO_2 is captured from refinery-based hydrogen production and sent for use in EOR, began operations. Through its Industrial Carbon Capture and Storage (ICCS) Program and with funding from the American Recovery and Reinvestment Act of 2009 (ARRA), DOE agreed to fund $284 million of the Port Arthur project's $430 million total investment cost. The Port Arthur project is expected to capture up to 1 million tons of CO_2 per year and enable EOR production of 1.6 million to 3.1 million barrels of domestic oil a year in East Texas.

DOE is also working on applying CCS to the power sector. Southern Company's coal-fueled Kemper County energy facility in Mississippi is now under construction and will be the first commercial-scale CCS power project in the United States. DOE selected the Kemper project to receive more than $290 million through its Clean Coal Power Initiative (CCPI). A later round of the CCPI made possible through ARRA funding selected three additional coal-fired CCS power projects for funding. They are Summit Power's Texas Clean Energy Project (TCEP), NRG Energy's Washington Parish Project, and SCS Energy's Hydrogen Energy California project. TCEP is nearing financial close and, when completed, will capture 90 percent of its emissions and supply approximately 2.5 million tons of CO_2 for use in EOR.

Given the high costs and uncertainties of CCS investment for the private sector and the urgent need for CCS, it is extremely important that the federal government continue to support CCS research, development, demonstration, and deployment. Beyond DOE's pivotal role, other forms of federal financial support, such as tax credits, should be reformed and expanded. States too can play a key role in advancing CCS through incentives and well-informed regulation.

Background on CO_2-EOR

CO_2-EOR is a means of commercial oil production that could play a key role in the development of CCS and in increasing our domestic energy security. CO_2-EOR has the potential to increase American oil production by tens of billions of barrels, while displacing imported oil and safely storing billions of tons of CO_2 underground.

How does CO_2-EOR work? Even after conventional primary and secondary oil recovery, most of the oil in a typical oil field is left in the ground. When injected deep underground, CO_2 can make it possible to recover more oil and extend an oil field's life. The best available evidence indicates that by using best EOR industry practice and existing rules governing underground injection, the overwhelming majority of the injected CO_2 remains underground, incidentally and safely storing CO_2. Commercial injection of CO_2 for EOR is regulated under EPA's Underground Injection Control Program, and under current federal greenhouse gas reporting rules for air emissions, EOR operators may document this incidental CO_2 storage through additional monitoring, reporting, and verification requirements to qualify as geologic sequestration. There is a range of views as to what additional state or federal rules are needed to ensure that CO_2 is stored permanently.

The United States has been a global leader in CO_2-EOR for 40 years. We currently obtain six percent of our domestic oil production through this method. While most CO_2-EOR activity occurs in the Permian Basin of Texas, there are also projects in the Gulf Coast, the Rocky Mountains, Oklahoma, and even Michigan. Estimates of the potential for CO_2-EOR to increase oil production and store CO_2 have been increasing in recent years. According to the National Energy Technology Lab, using existing techniques, CO_2-EOR could double or triple U.S. oil reserves and store 10 to 20 billion tons of CO_2, which is equivalent to between five and 10 years of emissions from all U.S. coal-fired power plants. More advanced techniques could yield much higher oil production and CO_2 storage.

The key role of CO_2-EOR in advancing CCS

For those CO_2 capture technologies that have not reached full commercialization, especially in electric power generation, selling captured CO_2 for use in EOR can provide a revenue stream that helps reduce the financial risks and uncertainty of investing in emerging technology. About 75 percent of the CO_2 used in EOR currently comes from naturally occurring CO_2 reservoirs. The rest comes from man-made CO_2 sources. Somewhat oddly, the EOR market lacks sufficient CO_2. By expanding carbon capture from man-made sources, we can increase domestic oil production, promote economic development, create jobs, reduce CO_2 emissions, and drive innovation in CCS technology.

It is because of these multiple benefits that we have been able to bring together the National Enhanced Oil Recovery Initiative, or NEORI, a diverse coalition favoring the reform and expansion of existing tax incentives to use captured CO_2 in EOR. Among the members of NEORI are Arch Coal, Summit Power, Tenaska, the Natural Resources Defense Council, AFL-CIO, and The Wyoming Outdoor Council. Some of NEORI's participants are primarily interested in job creation, others in increasing domestic oil production, and others in protecting the environment. But all agree that advancing the capture of man-made CO_2 for use in EOR

makes sense. NEORI has been briefing members on both sides of the aisle in both houses of Congress on its proposals.

EOR operators in some regions are willing to pay upwards of $30 per ton for CO_2. At the same time, industrial facilities and power plants are emitting billions of tons of CO_2 into the atmosphere as a waste. CO_2-EOR therefore offers the opportunity to transform this waste into a marketable commodity and transform an environmental problem into an energy production solution.

In a few cases, revenue from selling CO_2 for enhanced oil recovery is sufficient to pay for CO_2 capture and transport. Thanks to the efforts of the private sector and DOE, many CO_2 capture technologies are already commercially proven, and only a modest incentive is needed to help close the gap between the market price of CO_2 and the costs to capture and transport it. In the case of emerging technologies, however, companies need a larger incentive to help shoulder the additional financial and operational risk of deploying new, pioneering capture projects for the first few times at a commercial scale.

By combining private EOR operators' willingness to pay for CO_2 with a tax incentive, society leverages its public investment. Perhaps most importantly, according to our analysis, such tax incentives would more than pay for themselves by driving increased domestic oil production and associated taxable oil revenues. Increased CO_2-EOR production will generate federal revenue that more than pays for the cost of new incentives within a 10-year timeframe. Under existing tax treatment, CO_2-EOR directly yields revenues from three main sources: corporate income taxes, individual income taxes on royalties from production on private land, and royalties from production on federal land. Our analysis indicates that federal revenues from incremental CO_2-EOR production would exceed the fiscal cost of new incentives by more than $100 billion over 40 years.

Conclusion

CCS is a critical technology for reconciling our continued dependence on fossil fuels with the imperative to protect the global climate. Our best hope at the moment for CCS advancement is carbon capture, *utilization*, and storage, or CCUS. The best example of CO_2 utilization we know of is enhanced oil recovery (CO_2-EOR). Solving our climate and energy problems will require a portfolio of technologies, and all must be pursued vigorously. But we are focusing here today on CO_2-EOR, because it is the most important climate and energy solution that no one knows about.

Judi Greenwald, Vice President, Technology and Innovation

Judi Greenwald is the Vice President for Technology and Innovation at the Center for Climate and Energy Solutions. She oversees the analysis and promotion of innovation in the major sectors that contribute to climate change, including transportation, electric power, buildings, and industry. Ms. Greenwald focuses on technology, business, state, regional, and federal innovation. She is a member of the Advisory Council of the Electric Power Research Institute and served on several National Academy of Sciences panels studying vehicles and fuels. She also served on the Resource Panel for the northeast Greenhouse Gas Initiative and the California Market Advisory Committee, and as a policy advisor to the Western Climate Initiative and the Midwest Greenhouse Gas Accord Advisory Group. She was previously the Vice President for Innovative Solutions at the Pew Center on Global Climate Change, C2ES's predecessor organization.

Ms. Greenwald has over 30 years of experience working on energy and environmental policy. Prior to coming to the Pew Center, she worked as a consultant, focusing on innovative approaches to solving environmental problems, including climate change. She also served as a senior advisor on the White House Climate Change Task Force. As a member of the professional staff of the U.S. Congress Energy and Commerce Committee, she worked on the 1990 Clean Air Act Amendments, the 1992 Energy Policy Act, and a number of other energy and environmental statutes. She was also a Congressional Fellow with then-Senate Majority Leader Robert C. Byrd, an environmental scientist with the U.S. Nuclear Regulatory Commission, and an environmental engineer and policy analyst at the Environmental Protection Agency.

Ms. Greenwald has a Bachelor of Science in Engineering, cum laude, from Princeton University, and an M.A. in Science, Technology and Public Policy from George Washington University

Chairman LUMMIS. Thank you, Ms. Greenwald, and thank you, panel.

Now, if we would limit our questions to four minutes each, we could probably—everybody in this room could get to ask questions before our vote series. If there is no objection to going with four minutes instead of five, then so ordered, and we will start—the Chair now recognizes herself for four minutes. Thank you, panel, for being here. I am going to start with Mr. Collins.

In your testimony, you talked about integrated portfolio approaches to maximize benefits of coal. Could you tell us which of those technologies you believe are the most promising to improve energy utilization?

Mr. COLLINS. Yes, Madam Chairman. We have a process called WRITECoal that will extract the water out of low-rank coals that in the past has really been a missed opportunity. Low-rank coal, especially out of Wyoming, has been beneficial for reducing sulfur emissions because of its low sulfur content, and the water has just gone up the smokestack along with other emissions. By extracting that water at the front end, we can utilize that water in the power plant and reduce local water consumption in communities that are water stressed by about 50 to 60 percent for the makeup water, especially in air-cooled systems. So we see that as a second value of low-rank coals that were delivering water with the energy resource.

A second technology is a chemoautotrophic bacterial process that will operate in the dark 24 hours a day to consume CO_2 and make a bio crude oil that can be used to make synthetic diesel fuel, for instance, and perhaps even other longer-chain carbon molecules like biopharmaceuticals and turn that carbon in our coal into an additional economic resource by using it more than once, and that is our view to look at recycling energy.

Chairman LUMMIS. Thank you, Mr. Collins.

Now, Mr. Yamagata and Ms. Greenwald, I have a question about the fossil energy loan guarantees, and they were—monies were directed under the Energy Policy Act of 2005 to advance technologies and facilitate commercial application. Four projects were selected for further evaluation in July of 2009, and to date, no final loan guarantees have been issued. Your groups have focused in part on these loan guarantees and their status. To your knowledge, where are they in the DOE process? Mr. Yamagata, any response there?

Mr. YAMAGATA. Madam Chair, frankly, I don't know where they are. We know that the process that was started several years ago in which DOE actually accepted—because that is the process, the applications—and the DOE at least as we understand it, the Secretary or his designee can stop that process at any point in time but we don't know that that has ever happened with respect to those four projects. So the answer at least in short is, we are not quite certain where those projects are. They don't appear to have been rejected.

Chairman LUMMIS. Ms. Greenwald, do you know?

Ms. GREENWALD. We don't know either.

Chairman LUMMIS. Thank you.

Mr. Smith, I might ask, has DOE taken any steps to advance these projects?

Mr. SMITH. Thank you for the question, Madam Chairwoman. So I manage the Office of Fossil Energy, which oversees all the research and development that is done to advance fossil energy technologies. I don't have oversight over the loan guarantee program. I do know that the projects that were selected in that first round focused primarily on CTL technologies. We have recently announced an additional level of funding of $8 billion, which is another series of potential loan guarantees that would have a very wide range of applications for fossil energy technologies. We have taken the unprecedented step of offering that for public comment so we can get feedback back from industry, back from states, back from key stakeholders so that we can structure that in a way that has the highest probability of attracting the right type of participants and make sure that we are successful moving that forward. So that is the process that we are pushing for in real time right now.

Chairman LUMMIS. Thank you, panel.

And now I yield four minutes to the Ranking Member, Mr. Swalwell.

Mr. SWALWELL. Thank you, Madam Chair.

For our witnesses, it is pretty evident now after a number of scientific studies that 97 percent of scientists agree that human activities are causing climate change, and so I want to ask each one of you whether you agree or disagree with the 97 percent of scientists who believe in that.

Mr. Smith, do you agree or disagree?

Mr. SMITH. We agree that most of our programs are focused very strictly on reducing CO_2 emissions and greenhouse gas emissions.

Mr. SWALWELL. But do you agree that climate change is caused by human activities?

Mr. SMITH. We do agree that this is something we need to address, so we agree.

Mr. SWALWELL. Mr. Yamagata, agree or disagree?

Mr. YAMAGATA. You are not going to like this answer. We don't——

Mr. SWALWELL. Is it agree or disagree?

Mr. YAMAGATA. We don't take a position on that issue. It is not something that we want to deal with. What we want to deal with is if public policy determines that this is an issue, we have got to have the technologies available to address it.

Mr. SWALWELL. How about you personally, Mr. Yamagata? Do you agree or disagree?

Mr. YAMAGATA. I think there is a lot of information out there that suggests so.

Mr. SWALWELL. Mr. Collins, do you agree or disagree?

Mr. COLLINS. Thank you, Congressman Swalwell. I would say you probably won't like my answer either. There are multiple contributions to what people consider climate change, and it is not all just man made anthropogenic sources. So that statement, in my mind, is incomplete, so that is why I cannot agree to the question.

Mr. SWALWELL. Do you agree that human activity has played a role, a substantial role, in climate change?

Mr. COLLINS. Human activity releases a lot of energy into the environment that contributes to the warming, but I also view that

CO_2 is an untapped resource and we need to start thinking about how we utilize that. We live in a carbon-rich world. You and I are carbon-based life forms. To consider living in a carbon-free world to me sounds like suicide.

Mr. SWALWELL. And Ms. Greenwald, do you agree or agree with the 97 percent?

Ms. GREENWALD. We agree. I focus on the technology solution side of our organization but we do have staff that focuses on science, and we do work in that area and do agree with the scientific consensus.

Mr. SWALWELL. Great. Thanks, Ms. Greenwald.

Mr. Smith, over the history of research to reduce the environmental impacts of coal-fired power plants and to improve their efficiency, where has the bulk of the innovation taken place? Has that been in the private sector or has it been at the national laboratories or our research universities?

Mr. SMITH. Well, thank you for the question, and without making a direct comparison, I would say that this is an area in which it is critical for the government to be involved. We work very closely with private industry in all the major demonstrations that we are pushing out. We need to ensure that we have got scientists that work in national laboratories working alongside the practitioners in the field in industry, so that is always going to be a collaborative effort. That is the only way to move forward.

Mr. SWALWELL. And have Federal regulations played a role in incentivizing these innovations, and if so, how?

Mr. SMITH. Well, first of all, I think it is important that we fund critical programs that allow us to do this work. If you look at the investments that we have made since the start of this Administration, we have made a significant investment in major demonstrations that came from the Recovery Act, and in every year of the President's budget over the last several years, we have made important, significant investments in carbon capture and sequestration that fund that government programs and allow us to work together with industry.

Mr. SWALWELL. Great, and I will yield back in the interest of allowing more questions from our colleagues.

Chairman LUMMIS. I thank the gentleman. I now yield to the gentleman from Texas, Mr. Neugebauer, for four minutes.

Mr. NEUGEBAUER. Well, Madam Chairman, thank you for holding this important hearing.

Mr. Smith, the Environmental Protection Agency is moving forward with greenhouse gas regulations on both new and existing coal-fired plants. In EPA's initial regulatory proposal for new plants released last year, the EPA rulemaking assumed that CCS technology would be commercially available within ten years of plant initiating operations. Do you agree that with this new proposed rule, which I understand is now under revision, would have basically effectively banned the construction of new coal plants without CCS?

Mr. SMITH. Well, thank you for the question, Congressman. I can't comment on the rule as it has not yet been published. It is in interagency review at the moment, and that is a process that is being managed centrally. What I can say is that the Department

of Energy has an important role to play in terms of shaping that rule, and we believe it is critically important that we are working together with EPA and that we are working together with industry to ensure that these technologies are commercially ready, that they are being developed, that we are making the right investments, and that these innovations are created here in the United States so that we are creating that opportunity here for our country. So that is the role that the Department of Energy plays in that process.

Mr. NEUGEBAUER. Well, along those same lines, though, then would you agree that in order for CCS to be a part of the new coal plant that significant technical, legal, property rights and liability issues will have to be resolved?

Mr. SMITH. Congressman, I agree that there are myriad issues that need to be resolved, and that is the process that we are in real time going through. This is an important innovation that will allow us to achieve this mission.

Mr. NEUGEBAUER. So then with that in mind, what is the earliest time frame in which you can state with confidence that CCS will be commercially available for utility scale?

Mr. SMITH. Well, Mr. Congressman, I would state that currently, we know an awful lot about how to capture CO_2 and we know an awful lot about storing it. The work that we are going through right now is to ensure that we are continuing to push these costs down and that we are making it more and more affordable for broad-scale release. So I can't make a projection in terms of what exactly that cost curve is going to look like, but that is the process of innovation that we are going through now and we are making important strides in real time in that mission.

Mr. NEUGEBAUER. So I guess the question goes back to kind of where I started. If we can't get to that point, are we basically keeping new power plants from being brought online and potentially closing existing ones? The chairwoman mentioned some statistics of how many plants had been closed, so the vagueness of your answer leads me to believe that you are not sure whether this technology will be in place and that in fact would preclude bringing those plants online, wouldn't it?

Mr. SMITH. Well, coal is under stress from a number of factors including the emergence of natural gas that has pushed natural gas prices down, and natural gas has leapfrogged coal in a lot of areas in terms of how coal power plants get dispatched. That is a challenge, and it makes it difficult for these plants to move forward. What we are working on is making sure that we are not only focused on CCS, carbon capture and sequestration, and lowering those costs, but we are also working with industry to improve efficiencies, to improve processes, better sensors, better materials, to ensure that this important part of our energy mix continues to contribute to energy security in the future. It is—this is research activity. These are technological innovations. They don't have certainty, just as any research topic tends not to, but we are making investments to ensure that we are moving that forward and we do have high levels of confidence.

Mr. NEUGEBAUER. So would this be a true statement, that this Administration is not a big fan of coal?

Mr. SMITH. I would say that is categorically not a true statement. I mean, if you look at the investment that we have made since this Administration started, almost $6 billion invested in CCS technologies, greater efficiencies, better materials, better processes, more efficient turbines. These are all investments that we have made to ensure that this important source of domestic energy—coal—continues to be part of the clean energy economy of the future. So when we say all of the above, I mean, that is not a slogan. It is an investment this Administration has made over the past four years. So I actually would not agree with that comment, respectfully, Mr. Congressman.

Chairman LUMMIS. I thank the gentleman from Texas and yield to another gentleman from Texas, Mr. Veasey, and it is Veasey, isn't it?

Mr. VEASEY. That is correct, Madam Chair.

Chairman LUMMIS. You know, I had tee shirts made for my second campaign that said "Lummis rhymes with hummus" on them just because I got it to so much, so I suggest the tee shirt route, Mr. Veasey.

Mr. VEASEY. Yes.

Chairman LUMMIS. The gentleman is recognized for four minutes.

Mr. VEASEY. I have done "Veasey is easy" before.

And I wanted to ask Ms. Greenwald specifically if she could tell me a little bit more about her organization's work with important carbon capture and storage and reuse projects in Port Arthur as well as Pinwale, and for those of you that aren't from Texas, Port Arthur is a very important geographic area as it relates to energy and——

Mr. WEBER. And represented by the greatest Congressman in the world, I am just saying.

Mr. VEASEY. That would be Mr. Weber.

Ms. Greenwald, please.

Ms. GREENWALD. Well, I am glad to talk about projects that are near and dear to both of your hearts. We were actually just in Port Arthur recently. We had a workshop for state and provincial officials from both the United States and Canada talking about CO_2 EOR and its relationship to carbon capture and storage, and while we were there we did a site visit to the Air Products facility in Port Arthur, Texas, and that is a hydrogen production facility that is doing carbon capture, and they are using their CO_2. They are sending it into a pipeline to be used for CO_2 EOR. So it is a classic example of the kind of project that is really making a difference, moving ahead on carbon capture and also advancing our increasing U.S. oil production. So it is a great project. It is also getting DOE funding, so it is a huge DOE success as well. And so that has been a great project, and it just got up and running a few short months ago, and Air Products is also a member of our National Enhanced Oil Recovery Initiative group, and so they have been active in that as well.

Mr. VEASEY. Good, good. Let me ask you about CCS, and, you know, how would you compare the need to support CCS with the need to support other energy sources such as renewable energy or nuclear power? And I think particularly with renewable energy and

that support going hand and hand because it is something that we really don't, you know, talk about enough, and if we want to have a serious all-of-the-above approach, I think that we obviously need to.

Ms. GREENWALD. You know, the way we think about this is, we think about a strategy. We might say all-of-the-above clean. We basically think that all of these technologies—nuclear power, renewables, efficiency, carbon capture and storage with gas or coal—all of the most promising technologies we should be working on both in the R&D level but also in deployment and encouraging them to be used more in the marketplace. So we recommend that we pursue a portfolio approach and make sure that we have a range of technologies that are available. For us, it is all about performance. If any particular fuel or technology can give the environmental performance that we need and the energy security benefits that we need, that is what we want to achieve. So we don't come out and say this is the best technology.

As I said in my testimony, though, the reason we have been focusing on CO_2 EOR today and recently is that that is an example of a solution that a lot of people just don't know about, but we do support looking all across the board and making sure that we are placing bets on the most promising technologies so that they will be available for broader use in the marketplace and encouraging the use of the cleanest and most energy beneficial projects in the marketplace.

Mr. VEASEY. Thank you, Ms. Greenwald. I appreciate you answering those questions and I appreciate your work on these important energy and environmental issues. Thank you very much.

Madam, I yield back the balance.

Chairman LUMMIS. Thank you, Mr. Veasey, and the chair now recognizes the gentleman from Kentucky, Mr. Massey.

Mr. MASSEY. Before I ask my question, I just want to say that I have "friends of coal" plates on my car, and my car truly is a friend of coal. It got me here on time today because it is powered with coal. It is an electric car, and it is charged by coal power. So I am very excited about coal as an abundant resource here in the United States because it gives us the opportunity to have energy independence and releases us from some of these foreign entanglements. So I am very troubled by what looks like the Administration's bias against coal, and I have been told by the engineers in my district, they just brought online in 2011 a super critical boiler unit. It is a state-of-the-art coal-fired facility at the Trimble County station, but they told me the other day that even though this thing qualified for clean energy tax credits and whatnot two years ago, today it would be illegal to build. They wouldn't be able to build it because it doesn't comply with the Administration's rules that are going to be promulgated.

Mr. Smith, could you tell me, is that correct? Would it be impossible to build a compliant coal station today without CCS technology?

Mr. SMITH. Well, thank you for the question, Congressman. I can't respond to the specific instance because I am not familiar with the plant or the details behind it, and——

Mr. MASSEY. Would it be possible to build a coal plant without CCS technology that is compliant today?

Mr. SMITH. Again, we are not the regulatory agency so, I mean, I really can't answer questions that are specific to how the regulations operate. I can talk to the technology pathways that we are pursuing, our broad Administration goals, how we are working with EPA. I could address those points.

Mr. MASSEY. Okay. Well, I will assume they were correct in stating that.

Let me ask you a question then that maybe you can answer. I think we need to—because we are determining policy, we can't base it on opinions. I am an engineer, and I believe that without facts, all you have is an opinion. So I am looking for facts and numbers here today. If the Earth has warmed because of human activity, can you tell me what percentage of that warming was due to anthropogenic causes?

Mr. SMITH. Mr. Congressman, what I can say, you know, without getting into a detailed scientific discussion——

Mr. MASSEY. I am just looking for a number like a percentage.

Mr. SMITH. What I can tell you is that we do believe the anthropogenic CO_2 production, anthropogenic greenhouse gas emissions are an important component of global warming and it is something that we do have to comprehensively address.

Mr. MASSEY. That is an opinion. So let us take it into the realm of facts. What percent would you apply to anthropogenic causes?

Mr. SMITH. Again, Mr. Congressman, I am not going to go through a peer review of scientific studies, and to select a number, I can't say that it is comprehensively important. We could certainly provide your office with more detail.

Mr. MASSEY. Well, I would love to see those facts, because every time somebody from the DOE comes here, we ask this question. We have never gotten an answer to that question.

I do have another question that is based on math, and this is a little bit easier exercise. What is the percent cost increase in coal production, coal-produced electricity that you associate with CCS technology?

Mr. SMITH. Well, right now we are looking at three, I guess, separate tranches in the way that we think about the implementation of CO_2 technology.

Mr. MASSEY. If it were ideally implemented, what would the additional costs be to a kilowatt-hour?

Mr. SMITH. Well, Mr. Congressman, it would depend on the state of the technology at the point of implementation.

Mr. MASSEY. I think in your testimony notes, you said between 35 and 70 percent. Is that a good range?

Mr. SMITH. I think that would be a reasonable range.

Mr. MASSEY. Okay. So let us say it is 50 percent, and if a middle-class family had a $200 electric bill in Kentucky, 50 percent of $200 is what?

Mr. SMITH. That would be $100.

Mr. MASSEY. Okay. So their electric bill would go from $200 to $300, and in 12 months they would have another $1,200 electric bill. Does the Administration—does the DOE care that this is going to push some people below the living standard and that more peo-

ple may have to go on public assistance because of promulgating the carbon capture technology?

Mr. SMITH. The point that the—the position that the DOE takes on this is that these are technologies that are going to be critical to be developed. Our job is to make sure that they are done in a way that is most cost-effective, that minimizes the impact on consumers, that ensures that clean coal has a role in the clean energy economy of the future, ensures that we have energy security here in the United States, and that we have the maximum amount of energy diversity for families throughout the United States.

Mr. MASSEY. But you wouldn't dispute those numbers?

Mr. SMITH. I would say that if we do not move forward on these technologies, that we are not going to have a pathway to ensure that coal is part of the clean energy economy of the future. This is work that we must do to ensure that we do keep this important energy source.

Chairman LUMMIS. The gentleman's time is expired.

Mr. MASSEY. Thank you very much. I yield back.

Chairman LUMMIS. I am so sorry, Mr. Massie. The chair now recognizes the gentleman from California, Mr. Takano.

Mr. TAKANO. Thank you, Madam Chair.

Mr. Smith, I want to explore a little bit more about the competitiveness of coal vis-á-vis natural gas. Can you tell me the impact that the increased efficiency and the technology in terms of extracting natural gas have had on coal's competitiveness?

Mr. SMITH. Well, thanks for the question. It has had a pretty large impact. If we look at availability of natural gas and how it has changed over the past decade, you know, a couple data points. You know, I grew up in Fort Worth, Texas, as Mr. Veasey mentioned, the geographic mid center of the Barnett shale. When I grew up there, there was absolutely no gas production or very, very little, and now it has been an absolute boom. Prices for natural gas were, you know, creeping into the double digits at one point. They bottomed out at somewhere around $2 last year. And so as you have that large decrease in the price for natural gas, it makes—it brings another option for American consumers, and we think that is generally positive.

Mr. TAKANO. I mean, would it be fair to say that the viability of natural gas has become a war on coal?

Mr. SMITH. I would——

Mr. TAKANO. I am being a little facetious there. I am just saying that it seems like the market forces have more to do with coal's struggling than Administration policy.

Mr. SMITH. Markets have a lot to do with it, and it is also part of the rationale why we have to be working very closely with industry to make sure that we are working together to develop these technologies to make sure that coal remains relevant.

Mr. TAKANO. Well, let us talk a little more about coal versus natural gas. I mean, what makes natural gas such a more compelling source of energy on the fossil fuel side?

Mr. SMITH. Well, I would dispute the, I guess, categorization of more compelling because we think that energy diversity is very important and that in all-of-the-above, we have to make sure that we are using all of our energy sources. But I would say that natural

gas has the benefit of having half of the CO_2 impact, and right now it is much more affordable than it was just five years ago.

Mr. TAKANO. Thank you for that. I mean, I don't mean to cast—so it just seems to me, just looking at the Administration's policies, that the expenditures that it is seeking to make to—it looks like it is trying to make coal competitive. I mean, I would characterize the Administration's policies as not a war on coal but an attempt to make coal competitive with other sources of energy so we have—because it is plentiful in our country. It is something in our back pocket that we can develop potentially in the future for energy independence.

Mr. SMITH. We believe that energy diversity is a very important part of the all-of-the-above strategy. Coal creates a lot of jobs, it creates a lot of economic benefits in those parts of the country in which coal production is important. We firmly believe that we are going—the clean energy economy of the future is going to be a carbon-constrained world, and the only way that we can ensure that there is a role for all of our energy sources, which is going to be good for our economy, good for our energy security, is to move forward with research and development to ensure that we are doing something about the problem that we have with coal, which is, it is a major emitter of CO_2. That is the challenge that we have to rise to, and that is the heart of our collaboration with industry, to move forward on these technologies.

Mr. TAKANO. So the way I—so I see—thank you for your comment. I think the policy of the Administration is really an attempt to be supportive of coal, to keep it as a viable source of energy in the future because it is so plentiful in our country. It will help us with energy independence, and it truly does contribute to the all-of-the-above strategy.

Mr. SMITH. I think that would be an accurate characterization of what our intent is.

Mr. TAKANO. Thank you.

Chairman LUMMIS. I thank the gentleman and yield four minutes to the gentleman from Texas, Mr. Weber.

Mr. WEBER. Thank you.

Chris, good to see you. I haven't seen you since you were down in Port Arthur at the opening of that plant. You said in your conversation with Congressman Neugebauer that you would categorically say it is not true that the Administration was waging a war on coal, but let me talk about that very fundamental question of the future of coal in America as it relates to President Obama's policies.

During his first campaign, the President famously said that his objective was to bankrupt anyone that tried to build a coal-fired power plant. Since that time, the President has worked hard to deny he was "waging a war" on coal. However, after the President announced he intends to aggressively pursue new climate regulations last month, in a moment of candor, one of his key advisors said, and I am quoting, "Politically, the White House is hesitant to say they are having a war on coal. On the other hand, a war on coal is exactly what is needed." Now, that was one of the President's advisors.

So my question to you, Chris, and I have got a list here for you, is what is the Administration doing? Is it much more important than what the President and advisors are saying? Do they say one thing and do another? And let me just say, consider this list of the recent pending regulations affecting coal. Number one: carbon regulations—I think my colleague down here, Mr. Massie, talked to you about it—on new coal power plants, carbon regulations on existing coal power plants, utility MACT with EPA estimated compliance costs of $10 billion, the Cross State Air Pollution Rule, which I know you are familiar with, BACT, or Best Available Control Technology, rules for greenhouse gas emissions, particulate matter regulations, section 316(b) rule concerning cooling water intake, and the list goes on and on and on. Effluent limitation regulations costing between $200 million and $900 million per year, new EPA regional haze requirements, new EPA monitoring—excuse me—mountaintop mining rules, Department of Interior stream buffer zone regulations, and forthcoming ozone regulations which are projected to be the most costly regulation in the history of the U.S. government, most recently estimated by not your agency but the EPA to cost $90 billion annually. And yet we say that the President's Administration, with all due respect to my colleague from California, says that the gas market has waged a war on coal. That is the free market and American entrepreneurs will take that free market and they will make that work. They will make that adjustment. Consumers will respond by buying those products. But it is a fact, in my opinion, that this Administration has a war on coal. In fact, there is a YouTube video out on him where he was campaigning and he said under his energy plan, electricity prices would of necessity skyrocket. And I am sorry, I am out of time.

You say that your mission is to make sure that America has clean, affordable energy. You say the future is a carbon-constrained world. But don't you think that given what I just said is happening, the only thing that is going to be constrained is America's economy and our world competitiveness?

Mr. SMITH. Well, thank you, Congressman. There is a lot there so I will try to comment, I guess, on the——

Mr. WEBER. You have got lots of time, 28 seconds.

Mr. SMITH. Okay. Great. Well, last month I saw you were down in Port Arthur in your district where we were doing a ribbon cutting for the Air Products project, which I think was mentioned by one of the panelists. I think that is the—I mean, we can talk about who said what in an unattributed article but if you look at what we have actually done, particularly here within the Department of Energy, particular our research and development projects, we are taking concrete actions to ensure that coal remains relevant. Market forces are going to do what they do. Certainly the emergence of natural gas has had a big impact on coal. The technological innovations around shale gas have pushed natural gas prices down. We think it is important that as we go forward that we are making the research, we are putting the research in place to ensure that coal does continue to have a role.

Chairman LUMMIS. Thank you very much. I am sorry. The gentleman's time has expired.

Mr. WEBER. I yield back.

Chairman LUMMIS. The chair now recognizes the gentleman from Texas, Mr. Hall, chairman emeritus of this Committee.

Mr. HALL. Thank you, Madam Chairman, and thank you yesterday for your good questioning and answering of the EPA people here. I think you put them in their place properly.

I want to just touch on the climate change research causation that was inquired. I think Mr. Smith quickly said yes when he thought that it was people that had caused it. Causation. I just—you know, we were told 12 years ago that it was going to be halfway or 12 feet up on the Statue of Liberty, and it is less than a foot up on the Statue of Liberty. All kinds of warnings and people coming before us being paid a lot to come here to testify that scared us to death. And just like going to the moon. We are going to go to the moon but we are not going to the moon until the people can go to the grocery store, and on global warming, we better well be aware that we are not getting any help from anybody hardly in the world on that. We are doing it ourselves, and for what little has been done, we don't know whether people caused it or not. We have spent $34 to $38 billion for the small steps that have been taken. I think before you answer yes to something like that, you ought to know the causation and what it has cost the taxpayers to get what little we have got there, and I hope the record will reflect that.

Ms. Greenwald, I know you, and I have served with you and admired you always. I can't remember if you were a Republican or a Democrat, though, when you were here.

Ms. GREENWALD. Do I have to say?

Mr. HALL. No, you don't have to. I just remember that we worked on the Clean Air Act Amendments and the Energy Policy Act, and since then we passed another landmark energy policy, 2005 Energy Policy Act, and you have seen the development of new technologies in your position. Rather than government mandates, what are the most effective methods of advancing energy technologies and efficiencies when we have a President Obama with his mandates, and he has not just got a war on coal, he has a war on energy. Could you give me some kind of an answer to that?

Ms. GREENWALD. Well, we believe that to get clean energy sources and energy efficiency into the marketplace requires a combination of policy and making sure that the market can work. So that is why we advocate for flexible policies and incentives so that you can set targets and requirements, but you leave to the private sector as much as possible the ability to make choices so that they pick the best technologies that can meet your environmental——

Mr. HALL. We need to be aware of it and abreast of it and never forget it and looking at it every day, but we need to be reasonable about what we have to spend with no help from people that ought to be assisting us. Have you answered my question? I think you have.

I will use the rest of my time. I have about 37 more seconds to go here. I am a coal—I am from Texas and I am a fossil fuels and oil and gas guy but I have seen coal operation make significant investments and progress in advancing clean air emission controls and employing advanced technology, so I am heavy on coal and I think that we really—this is an important meeting, and I thank all of you for your service. I yield back my five, four, three, two, one,

time. Thank you, Madam Chairman. Thank you for your good work yesterday.

Chairman LUMMIS. Thank you very much.

We made it. The votes have been called on the Floor of the House, and everyone was very cooperative so everyone got to participate in this hearing today. We thank the witnesses so much for your valuable testimony and the Members for their questions. Members of the Committee may have additional questions for you, and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments and written questions from Members. We will look forward to your responses to those questions that you may be receiving shortly.

Before we adjourn, I ask unanimous consent to enter into the record two items. First, a letter signed by 23 Members of Congress, including me, to President Obama on July 22nd expressing our concern about the implementation of the New Source Performance Standards addressing greenhouse gas emissions for new and existing power plants. And secondly, two charts from DOE's International Energy Outlook, which was just released this morning showing the forecast for global coal demand, which is projected to increase by 39 percent in the next 20 years. Without objection, so ordered.

[The information appears in Appendix II]

Chairman LUMMIS. Obviously, those charts indicate that the subject of today's hearing is tremendously relevant, and the challenges exist for the technology that you espoused in your testimony, Mr. Collins. Ms. Greenwald. We look forward to your continued work, Mr. Yamagata, as well as the Department of Energy's continued work on fossil fuel technologies.

The witnesses are excused with our deep gratitude, and this hearing is adjourned.

[Whereupon, at 10:45 a.m., the Subcommittee was adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Mr. Chris Smith

QUESTIONS FROM REPRESENTATIVE CYNTHIA LUMMIS

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Hearing on the Future of Coal: Utilizing America's Abundant Energy Resources
July 25, 2013

Q1. Please provide the current status of and outlook for the advanced fossil fuel conditional loan guarantees announced in 2009. Why have those conditional loan guarantees not yet been finalized?

A1. The Department has not issued any fossil energy conditional commitments to date.

Current applicants for fossil energy loan guarantees as of August 26, 2013 are as follows ($millions):

Program	Authority	Sector	Project Name	Requested Loan Amount
Fossil Projects - Due Diligence Pipeline				
Title 17	1703	Coal Gasification	Project 1	$ 2,815
Fossil Projects - On Hold				
Title 17	1703	Coal Gasification	Project 2	$ 1,750
Title 17	1703	Coal Gasification	Project 3	$ 1,700

Each of these projects has a number of open issues that need to be resolved before DOE could determine, as is required by statute, that there exists "a reasonable prospect of repayment of the principal and interest on the obligation by the borrower." Some of these issues involve local and state legislatures or other governing bodies, on which the Loan Programs cannot force a timeline.

QUESTIONS FROM REPRESENTATIVE CYNTHIA LUMMIS

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Hearing on the Future of Coal: Utilizing America's Abundant Energy Resources
July 25, 2013

Q2. In April, a report issued by the MIT Energy Review concluded that even with revenues from enhanced oil recovery (EOR), natural gas prices would have to be above $9 for a CCS plant to be economically preferable over natural gas. The Energy Information Administration is projecting that natural gas prices will remain below $6 for at least the next 20 years.

b. Please provide a detailed list of all non-CCS research activities, including award recipient, project description, date, funding amount, and length of activity.

A2b. All of the projects in the Fossil Energy (FE) clean coal program support FE's mission to enhance national energy security and to reduce emissions of greenhouse gases (GHG) from fossil fueled energy systems. **However, many of these projects also contribute toward the achievement of multiple other energy-related goals**. For example, advanced Integrated Gasification Combined Cycle (IGCC) plants reduce GHG emission due to their high efficiency and their ability to more easily separate CO2 from the process. However, depending on the process configuration, advanced IGCC plants can be used to produce electric power and/or chemical products. This concept, known as polygeneration, can be used to take advantage of changes in market demand and prices for products over time. Similarly, solid oxide fuel cells (SOFC) also offer high efficiency and an easily separated CO2 stream but in addition can operate at < 20% load (great for grid stability where large fluctuations in energy generation or demand exist) and provide a way to produce electric power, heat, and water from the same unit. In addition, innovative materials, sensors, and controls that are necessary for development and

operation of these and other technologies e.g. advanced ultra-supercritical steam cycles, can be applied broadly to both the existing U.S. fleet of fossil fuel plants and to new plants resulting in improve efficiency, reliability, and lower cost operation.

QUESTIONS FROM REPRESENTATIVE CYNTHIA LUMMIS

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Hearing on the Future of Coal: Utilizing America's Abundant Energy Resources
July 25, 2013

Q3. DOE recently announced the availability of an $8 billion in authority for loan guarantees for advanced fossil energy projects. Are current activities funded through the Clean Coal Power Initiative or as part of the American Recovery and Reinvestment Act CCS demonstration projects eligible for these loan guarantees?

A3. The $8 billion in loan guarantee authority that has been allocated to fossil projects was made available under the Omnibus Appropriations Act of 2009. That Act prohibits the use of such authority, subject to certain limited exceptions, for loan guarantees for projects where "funds, personnel or property…of any Federal agency…are expected to be used…to support the project or to obtain goods or services from the project". Compliance with this limitation must be certified by the Director of the Office of Management and Budget. The determination whether this restriction would render a specific project ineligible for the 2009 loan guarantee authority is necessarily fact specific, and must be based on a thorough understanding of the project. It is not possible to say with certainty how a broad category of projects may be affected by the restriction.

QUESTIONS FROM REPRESENTATIVE CYNTHIA LUMMIS

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Hearing on the Future of Coal: Utilizing America's Abundant Energy Resources
July 25, 2013

Q4. The National Coal Council (NCC) is a Federal Advisory Committee tasked with advising the Secretary of Energy – at his request – on general policy matters relating to coal. The last five NCC reports focused exclusively on CCS and the NCC has not weighed in on non-CCS coal issues in over seven years. Given the critically important non-CCS technology and regulatory issues facing the coal industry, there are why hasn't DOE tasked the NCC to undertake a broader review of coal policy issues? Will DOE task NCC with such a request? If not, what is planned instead?

A4. For the past decade, the Department has focused on the issues associated with the largest market for the use of coal in the United States. That market by far is electrical power. Over the years, the NCC has produced excellent reports on a variety of topics including regulatory, policy, technology and market issues. The Department is presently in discussions with the NCC regarding the next study. There are a broad range of topics being considered including one related to coal policy issues.

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Q5. Please provide the current status of and outlook for the eight remaining CCS demonstration projects, including DOE obligated amounts, current phase, spending project to date, whether the project has received accelerated funding, and DOE/recipient cost share amounts and commitments by phase. Please also provide forthcoming key factors and decision points of the eight remaining CCS demonstration projects and how DOE will examine those points to determine each project's viability.

A5. Listed below is the information requested on the eight remaining carbon capture and storage (CCS) demonstrations projects:

- Demonstration of a Coal-Based Transport Gasifier; Southern Company Services; Kemper County, Mississippi; ~$4.1B est. total plant cost, DOE share $270M ; Integrated Gasification Combined Cycle (IGCC); 3,000,000 tons of CO_2/year to EOR. Construction is continuing (~72% complete); shakedown of various unit operations has commenced with full integrated operations to begin in May 2014.
- Texas Clean Energy Project; Summit Texas Clean Energy LLC ; Penwell, Ector County, Texas; $3B total est. cost, DOE share $450M ; IGCC/polygeneration (baseloaded); 2,200,000 tonnes of CO2/year to EOR (Financial close expected in October 2013 with construction to begin shortly thereafter). Plant operation is scheduled to commence in late 2017.
- Hydrogen Energy California (HECA) Project; Hydrogen Energy California LLC (a project company owned by SCS Energy); Bakersfield, Kern County, California; $5B

total est. cost, DOE share $408M; IGCC/polygeneration (load following); 2,570,000 tonnes of CO_2/year to EOR. Financial close expected in June 2014 with construction beginning in January 2015. Plant operation is scheduled to begin in mid-2019.

- W.A. Parish Post-Combustion CO_2 Capture & Sequestration Project; NRG Energy; Thompsons, Texas; $775M total est. cost, DOE share $167M; post-combustion capture at an existing coal-fired power plant; 1,400,000 tonnes of CO_2/year to EOR. Financial close is expected in March 2014. Operation is expected to begin in mid-2016
- FutureGen 2.0; FutureGen Alliance, Meredosia, Morgan County, Illinois; $1.77B total est. cost, DOE share $1.05B; oxy-combustion repowering; 1,000,000 tons of CO_2/year to saline storage. Financial close is expected in summer 2014 with construction beginning in the Fall 2014. Plant operation is expected to commence in mid-2017.
- Demonstration of CO_2 Capture and Sequestration of Steam Methane Reforming Process Gas Used for Large-Scale Hydrogen Production; Air Products & Chemicals; Port Arthur, Texas; $431M total est. cost, DOE share $284M. CO_2 from steam methane reforming for hydrogen manufacture at an oil refinery; 925,000 tonnes of CO_2/year to EOR. Plant operation began in December 2012 and reached full capacity in March 2013. As of August 14, 2013, over 420,000 short tons of CO_2 have been sold for EOR.
- CO_2 Capture from Biofuels Production and Storage into the Mt. Simon Sandstone; Archer Daniels Midland (ADM); Decatur, Illinois; $208M total est. cost, DOE share $141M (ARRA) (68%); CO_2 capture from an ethanol plant; 900,000 tonnes of CO_2/year to saline storage. Construction is continuing (~50% complete)' shakedown and commissioning of the CO_2 compression and dehydration facilities has been

initiated. Awaiting EPA Class VI injection well permit, expected January 2014, to begin drilling well. Plant operation expected to begin in July 2014, assuming EPA Class VI operating permit is issued in June 2014.

- Lake Charles Carbon Capture & Sequestration Project; Leucadia Energy LLC; Lake Charles, Louisiana; $436M total est. cost, DOE share $261M; CO_2 capture from a petroleum coke-to-methanol gasification facility; 4,500,000 tonnes of CO_2/year. Financial close is expected by December 2013 with construction to commence in January 2014. Plant operation is expected to begin in mid-2017.

QUESTIONS FROM REPRESENTATIVE CYNTHIA LUMMIS

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Q6. The Department of Energy's flagship CCS demonstration project, FutureGen, has been fraught with cost overruns, project delays, and an ever-changing membership of the private consortium. Please provide an update on this project and the outlook for its successful completion.

A6. Former Secretary Steven Chu approved the continuation of the FutureGen 2.0 Program into Phase II in February 2013. This approval entailed the creation of several sub-phases designed to ensure the project meets important milestones on an aggressive schedule. At this time, the FutureGen project is on track to meet all of its Phase II milestones, and remaining funds are being expended in a timely manner. The FutureGen program has spent $92 million of the $1.048 billion obligated to the project, leveraging an industry investment of ~$717 million. Construction is currently scheduled to begin after financial close in Fall 2014 with operation commencing in Summer 2017.

QUESTIONS FROM REPRESENTATIVE KEVIN CRAMER

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Hearing on the Future of Coal: Utilizing America's Abundant Energy Resources
July 25, 2013

Q1. The Environmental Protection Agency is moving forward with greenhouse gas regulations on both new and existing coal-fired power plants. In EPA's initial regulatory proposal for new plants released last year, the EPA rulemaking assumed that CCS technology would be commercially available within ten years of a plant initiating operations.

a. Mr. Smith, do you agree that the proposed EPA rule – which I understand is now under revision – would effectively ban the construction of new coal plants without CCS?

A1a. On September 20, 2013, the EPA issued a new proposal for Carbon Pollution Standards for New Power Plants. The proposed limits for fossil-fuel-fired utility boilers and IGCC units are based on the performance of a new efficient coal unit implementing partial carbon capture and storage (CCS).

QUESTIONS FROM REPRESENTATIVE KEVIN CRAMER

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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Q1. The Environmental Protection Agency is moving forward with greenhouse gas regulations on both new and existing coal-fired power plants. In EPA's initial regulatory proposal for new plants released last year, the EPA rulemaking assumed that CCS technology would be commercially available within ten years of a plant initiating operations.

b. Would you also agree that in order for CCS to be part of a new coal plant, significant technical, legal, property rights, and liability issues must first be resolved?

A1b. In 2010, the Interagency Task Force on Carbon Capture and Storage issued a formal report regarding the status of carbon capture and storage (CCS) technology. The report found that "while there are no insurmountable technological, legal, institutional, regulatory or other barriers that prevent CCS from playing a role in reducing GHG emissions, early CCS projects face economic challenges related to climate policy uncertainty, first-of-a-kind technology risks, and the current high cost of CCS relative to other technologies." The report further found that the key barrier to CCS deployment is the lack of comprehensive climate change legislation.

A number of commercial-scale CCS demonstration plants supported by DOE will begin operation over the next five years, and these plants are expected to show considerable progress in addressing current challenges to CCS deployment.

QUESTIONS FROM REPRESENTATIVE KEVIN CRAMER

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Q1. The Environmental Protection Agency is moving forward with greenhouse gas regulations on both new and existing coal-fired power plants. In EPA's initial regulatory proposal for new plants released last year, the EPA rulemaking assumed that CCS technology would be commercially available within ten years of a plant initiating operations.

c. With that in mind, what is the earliest time frame in which you can state with confidence that CCS will be commercially available at utility scale?

A1c. Several commercial carbon capture and storage (CCS) technologies have already been developed in different industries and applications. Current carbon capture and storage (CCS) electricity generation and industrial demonstration projects are focusing on 1st generation technologies which are available today. These projects will begin operation over the next 5 years. These facilities are expected to show that CCS can be operated reliably, predictably, and safely at utility scale. The next generation of transformational CCS technologies will be even more economically attractive.

QUESTIONS FROM REPRESENTATIVE KEVIN CRAMER

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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Q2. Your testimony notes that commercial scale CCS will increase electricity prices between 35 and 70 percent. How is this pursuit consistent with your office's mission to ensure the nation can continue to rely on coal for affordable energy?

a. Please explain why DOE has decided to place nearly all of its resources into an unproven technology that, even if "successful," would increase electricity prices so dramatically, instead of a more balanced approach that could improve the efficiency and environmental performance of existing coal plants.

A2a. The Office of Fossil Energy is charged with advancing technologies related to the reliable, efficient, affordable, and environmentally sound use of fossil fuels, which are essential to our Nation's security and economic prosperity. The focus of our research is reducing the overall cost of CCS by reducing CO_2 capture cost and other plant costs by improving plant efficiency and developing more cost-effective environmental controls.

With respect to the current cost of CCS systems, our studies show that CCS does add a cost relative to current wholesale electricity prices. Actual impacts on end users would depend on a range of factors including: ability to sell CO2 or other byproducts, local regulatory structure (e.g. some areas of the country currently have carbon prices) and whether the project receives other incentives (local and/or federal), as well as the level of capture implemented. In addition, in the absence of comprehensive climate change legislation the cost of energy related CO2 emissions is a negative externality borne upon the general public. FE RD&D is currently developing 2nd generation technologies that

will improve the efficiency and reliability of carbon capture processes to facilitate the transition to a low-carbon energy system. Using recent EIA natural gas price forecasts, systems analyses indicate that a coal-fueled power plant with 2nd-generation CCS technologies could produce electricity at a cost that is competitive with a NGCC power plant without CCS. These technologies would be competitive when the CO_2 captured by the coal plant is sold for use in enhanced oil recovery (EOR). RD&D pathways are being explored that could further reduce CCS cost.

When evaluating the potential of advanced technology, it is important to consider both the potential future performance of a technology as well as future prices. A large portion of the Fossil Energy RD&D is focused on improving the efficiency and reducing the cost of the base power plant through gasification and other advanced power system improvements. In the past, FE has adjusted its R&D portfolio to be responsive to Administration and Congressional priorities, and will continue to do so if further diversification in its RD&D program is needed.

QUESTIONS FROM REPRESENTATIVE KEVIN CRAMER

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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Q3. The Western Research Institute is developing WRITECoalTM gasification technology[4] to greatly increase the efficiency of coal gasification. Will this technology be available for commercial application in the timeframes called for in the president's greenhouse gas regulations on new power plants?

A3. On September 20, 2013, the EPA issued a new proposal for Carbon Pollution Standards for New Power Plants. This technology could be available for commercial application in the timeframes called for in this proposal. The current R&D project ended in 2011 after successful bench and pilot scale testing of individual components of the technology.

[4] The WRITECoal Gasification technology is one that combines gasification with a coal upgrading process to significantly enhance efficiency and reduces capital cost. The technology is being developed by WRI with activities at a pilot scale today. The Lignite Research Council is contributing funds toward this technology along with the Department of Energy and the State of Wyoming.

QUESTIONS FROM REPRESENTATIVE KEVIN CRAMER

U.S. HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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Q4. Are the resources available to affect technology development called for in the CURC road map developed with input from DOE, the Electric Power Research Institute, and the Coal Utilization Research Council membership?

a. Is the timeline outlined in the administration's proposed regulation consistent with the time required to allow for technology development and commercialization?

A4a. Today, the Department's Fossil Energy Clean Coal Program has the resources necessary to maintain a diversified advanced power systems and carbon capture and storage (CCS) research and development technology portfolio in order to achieve the cost, performance and environmental goals consistent with those outlined in the CURC road map. The new proposal for Carbon Pollution Standards for New Power Plants issued on September 20, 2013, is consistent with this research, which is focused on developing technology options that dramatically lower the cost of capturing carbon dioxide from fossil fueled energy plants.

Responses by Mr. Ben Yamagata

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Subcommittee on Energy

Hearing Questions for the Record
The Honorable Cynthia Lummis

The Future of Coal: America's Abundant Energy Resources
Mr. Ben Yamagata

1. **There has been considerable speculation that the revision to EPA's 2012 proposed greenhouse gas regulations for new power plants will shift away from a presumption of CCS-driven compliance and instead focus on the simply mandating dramatic efficiency increases. How can DOE best contribute to the ability of coal powered facilities to meet the revised standards? Similarly, how can DOE contribute to industry efforts to comply with forthcoming regulations on existing plants so they will not be shut down?**

CURC would be supportive of any EPA regulations that implement new NSPS for greenhouse gases (GHG) for new coal-fueled power plants if such regulations were focused upon efficiency increases rather than CCS technology installations, which CURC has noted are not yet commercially available.

If provided sufficient time and adequate public financial support through public and private partnerships, we project that such CCS systems will be commercialized and cost competitive with other clean energy sources. For new units, improvements in overall power plant efficiency for combustion-based systems as well as significant cost reductions in gasifiers and improved gas turbines are projected to result in a levelized cost of electricity (LCOE) for these advanced coal fueled systems with CCS that is lower than today's coal-fueled power plants without CCS. CURC, in cooperation with EPRI (the Electric Power Research Institute), has developed a coal technology Roadmap that outlines these technology development needs and opportunities (please see: www.coal.org).

It is important that the DOE continue to develop these technologies and have sufficient funds to ensure a diverse portfolio of options are available to compete in a clean energy future, one which will include significant fossil fuel resources.

The Administration's FY 2014 recommended funding level of $276.6 million is not sufficient to accomplish the important R&D necessary to support the technology development that is needed. Neither is the amount of appropriations provided by the House of Representatives in its FY 2014 Energy and Water Appropriations bill for the Department of Energy's coal R&D program. Reduced federal funds will reduce private and public investments, slow development timelines, and could cause the abandonment of promising new technologies at a time when we should be aggressively supporting the development of technologies designed to overcome environmental concerns of coal use. The CURC-EPRI Roadmap recommends $372 million per year in funding for DOE's coal R&D program for fiscal years 2014 through FY 2018.

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Finally, the CURC is currently investigating possible R&D collaborative efforts with industry directed at our nation's fleet of existing coal fired units. Issues related to unit reliability, flexibility, efficiency and modeling of water use for a variety of coal technologies as well as to develop technologies to reduce water withdrawal and consumption at power generation facilities. Importantly, these potential areas of cooperative R&D are intended to best ensure the continued operation of our low cost, highly reliable existing coal fleet.

2. What are the potential economic and energy security consequences of recent and forthcoming EPA regulations on existing coal-fired power plants? How might DOE's $370 million coal R&D portfolio be better prioritized to help coal utilities comply with tightened regulations while improving environmental performance?

Other organizations, including the Energy Information Administration (EIA), have concluded that a variety of market related circumstances (i.e. the cost and availability of natural gas, and environmental regulations; e.g. the regulation of hazardous air pollutants, particularly mercury) will likely cause the retirements of a significant number of existing coal units -- at least 50GWs of coal-fired capacity out of a total of 310 GWs have already been announced for retirement. EPA has been directed by the President to issue proposed section 111(d) Clean Air Act regulations by June of 2014 to regulate carbon dioxide (CO2) emissions from existing coal-fired units. These proposed regulations could have a significant impact upon existing units, as well. EIA, for example, projects that coal-based generation will decline by 60 – 94% between 2012 and 2040 if CO2 regulations result in a "cost" of $15 to $25/tonne of CO2. With current carbon, capture and sequestration (CCS) technologies costing 3-4 times these amounts, it is only through a robust and focused coal R&D program that we can bring down costs. And, in addition to CCS technology development, we believe that DOE's coal R&D program should be more balanced to address other critical technology areas important to continued coal use in the US. For example, the program does not focus upon those technology needs applicable to the existing fleet of coal power plants – that will in turn assist in complying with forthcoming EPA regulations – by addressing improved efficiency, reliability, water management, and flexibility in generation.

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3. The CURC-EPRI Coal Technology Roadmap identifies a number of research areas not currently being addressed by DOE that may warrant additional investment. Among those, what one or two areas should be the highest priority?

CURC fully supports the Department's development of cost-effective technology to capture and use or store CO2. However, there are several other areas of critical technology development that require attention and support.

For example, the CURC-EPRI Roadmap recommends establishment of a water management program. In addition, CURC has long called for a well-funded program to develop advanced materials to support the increased temperatures and pressures of advanced coal using systems. Much progress has been made with industry and next steps include the development and funding of a pilot facility to ensure that these advanced material efforts are expeditiously furthered.

Additionally, as noted in the CURC/EPRI Roadmap, the DOE program also should support "breakthroughs" in technology R&D across several program areas that encourage revolutionary approaches to converting coal to useful energy and products. Importantly, the emphasis of this initiative is a focus on new ways to use coal. An example of a breakthrough technology might include the substitution of biosystems for current chemical processes.

4. Coal generates approximately 40% of global electricity and developing nations continue to build coal-fired power plants at a rapid rate. Even if the United States does not construct any new coal-fired power plants, there will be an extensive worldwide market for the material and system components for new units. Please describe the global market implications for fostering domestic expertise in associated coal technology systems.

As we consider questions about climate change and U.S. regulatory programs, we believe it is worth noting that if the United States simply were to abandon coal, a scenario that is unrealistic, the impact to global CO2 emissions would be relatively small. To combat global CO2 emissions, the U.S. must play a lead role in the development of technologies that can (and will) be deployed in China and India and elsewhere, to reduce global carbon

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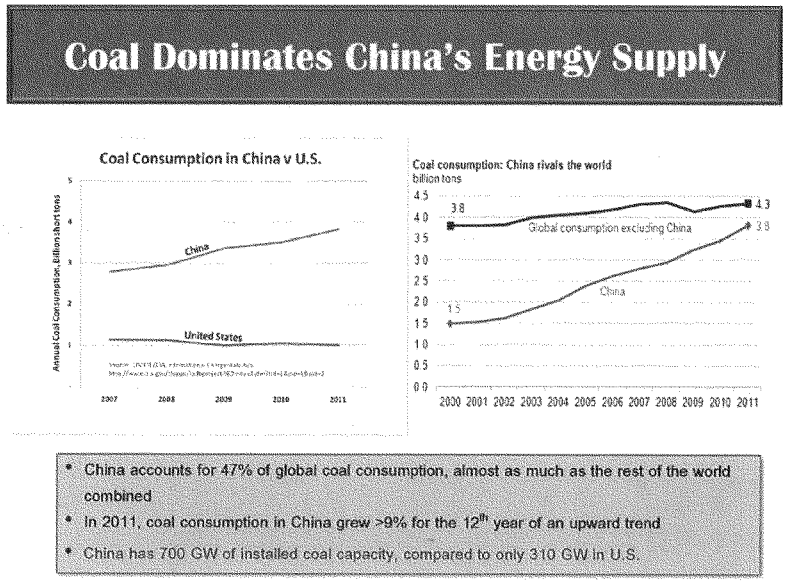
emissions. Without technology innovation in this country, and initiatives sponsored and supported by the Department of Energy (DOE), a significant reduction in global GHG emissions is unlikely (see chart below).



We do not believe, given the current lack of any consensus among nations to address CO2 globally, that CCS technology development will occur without strong U.S. leadership. It is generally recognized, also, that coal use worldwide will grow enormously as noted in the charts above. Thus, if CO2 abatement is to be addressed and coal use continues at such a dramatic rate, then CCS technologies must be developed. U.S. technology leadership, under these circumstances is vital and taking this leadership position will ultimately place

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Mr. Ben Yamagata

U.S. industry in the forefront with the technologies and know-how to address CO2 emissions.

Responses by Mr. Don Collins

Western Research
INSTITUTE

TESTIMONY

Follow up Question Responses

Donald W. Collins, Jr.

Chief Executive Officer

Western Research Institute

Laramie, Wyoming

Submitted to the

Honorable Cynthia Lummis

Chairman

Before the

Subcommittee on Energy

Committee on Science, Space and Technology

U.S. House of Representatives

Hearing on The Future of Coal:

Utilizing America's Abundant Energy Resources

July 25, 2013

Western Research
INSTITUTE

1. **Low rank coal resources are defined in part because of the high water content embedded in the resources. With the ongoing drought in the west and southwest, is there sufficient water contained in this coal that might help alleviate the strains on the water system?**

We believe the answer is yes as every contribution will be important to help alleviate strains on water systems in drought regions of the U.S. The lack of water in drought risk areas of the west and southwest is a high priority of the power industry from the perspective of continued operation with the existing fleet, as well as future steam-based power plants (e.g., nuclear, natural gas combined cycle, concentrated solar, biomass and coal). It is essential to explore every opportunity to lessen the distress in this important region of the U.S. Low-rank coals provide one such opportunity as water is delivered with low-rank coals, and the U.S. is rich in low-rank coal resources. In the past this natural source of water has gone untapped. New technology allows utilization of water delivered with low-rank coals such that local water consumption for plant feedwater could be significantly reduced.

Currently, subcritical plants typically receive water from surface structures (e.g., rivers) and/or from groundwater. All steam-based and water cooled power plants thereby compete for water with household, agricultural, recreational and other commercial usages. Power plants use water in three specific areas (1) boiler feedwater, (2) wet scrubber or spray dryer absorber for SO_2 emissions; and (3) condenser cooling in cooling towers. Each of these areas requires make-up water of different quality and level of treatment. Figure 1-1 provides the water quality and cost for pulverized coal (PC) and circulating fluidized bed (CFB) plants. Water recovery benefits projected with retrofit of WRITECoal technology highlights the benefit for boiler feedwater – the highest quality and highest cost water use within PC and CFB plants. The largest consumption of water is for cooling tower make-up water. The net consumption of water with recycle is approximately 25% based on a 4:1 cooling tower cycle concentration discharge, which is typically used to condition the ash co-product.

Sources of Water Make-up for PC & CFB Power Plants

	Water Quality	WRITECoal™ Recovery use
Boiler Feed-water	High Quality & Cost	Yes 100%
SO_2 Scrubbers	Low Quality & Cost	Yes (18-25%) No Upgrading
Cooling Towers	Medium Quality & Cost	Yes No Upgrading

Note CFB's use dry in-bed sorbent for SO_2 capture, thereby no water use or loss.

Figure 1-1. Comparison of Conventional Coal Plant Water Use Areas and WRITECoal™ Clean Coal Technology Process

The WRITECoal™ process uses plant waste heat in large part to (1) reduce water consumption for plant use, (2) remove approximately 75%, or more, of the mercury from low-rank coal, (3) increase efficiency, and (4) lower the cost of electricity by utilizing low-rank coals. The WRITECoal™ process provides clean water that can be used in any of the three plant areas with in some cases with minimal water treatment. For a 550 MWe subcritical plant the amount of water recovered by the WRITECoal™ process from a 28% moisture Powder River Basin coal is 213 gpm, while the water recovered from a 38% moisture North Dakota lignite is 316 gpm. This amount is enough water to meet 100% of the boiler feedwater makeup which is the most expensive and has the highest quality water standard requirements. Optionally, the water from low rank coals extracted by the WRITECoal™ process can be used to supply 18% to 28% of the makeup water for the lower quality scrubber/SDA or the cooling water.

National Energy Technology Laboratory (NETL) analysis results shown in Table 1-1 depict the water demand, the internal recycle (process discharge), and the raw water withdrawal for an existing 550 MWe subcritical plant without CO_2 capture has a water demand of 6,553 gpm and a raw water net consumption of 5,270 gpm. With Econamine CO_2 capture (emissions of 1,100 lbs CO_2/MWh), the water demand is 8,048 gpm and raw water consumption of 6,352 gpm and with 90% CO_2 capture (emissions of 334 lb/MWh), the water demand is 8,948 gpm, and water net consumption of 6,869 gpm. This increase in water demand and net consumption with increase CO_2 capture is the result of an increase in cooling load and the significant use of low pressure (LP) steam by the Econamine process.

Table 1-1. Make-up Water by Use Category with Different Levels of CO_2 Capture[1]

	No CO_2 capture	62% (1,100 lbs/MWh)	90% (334 lb/MWh)
BFW Make-up	**78**	**78**	**79**
FGD Make-up	**846**	**858**	**852**
Cooling Tower Make-up	**5,629**	**7,089**	**7,985**
Total	**6,553**	**8,048**	**8,948**

Table 1-2 shows the water demand for wet cooling condensers and hybrid cooling (50% wet and 50% air). For the non-capture supercritical (SC) PC and ultra-supercritical (USC) PC, the water demand was reduced by 1,760 and 1,700 gpm/MWnet respectively for the hybrid cooling system compared to a wet cooling system yielding a 46% reduction in water usage. The non-capture CFB hybrid reduces the water demand by 1,730 gpm/MWnet compared to an all wet system for a 49% reduction.

For 90% CO_2 capture, the SC and USC PC the reductions are 1,270 gpm/MWnet and 1,130 gpm/MWnet respectively for about an 18% reduction. For the 90% CO_2 capture CFB plant the reduction in water demand is 19% (1,250 gpm/MWnet).

[1] The water demand/consumption shown in Table 1-1 is from DOE/NETL-401/110509 report dated November 2009 and is based on a wet cooling tower.

Western Research INSTITUTE

Table 1-2. Impact of Cooling Tower Type on Water Demand (gpm/MWnet) and Relative Costs.

	Subcritical PC		SC PC		Relative
	No Cap	90% Cap	No Cap	90% Cap	Cost
Wet Cooling	3826	6684	3696	5947	1X
Hybrid* Cooling	1760	1270	1700	1130	2X
Air Cooling	0	0	0	0	3-4X

Note. CO_2 capture by Econamine

Figure 1-2 shows the water demand and water consumption for a range of new or new coal-fired power plants. (DOE/NETL-2011/1463). Figure 1-2 includes the CFB SC case mentioned earlier.

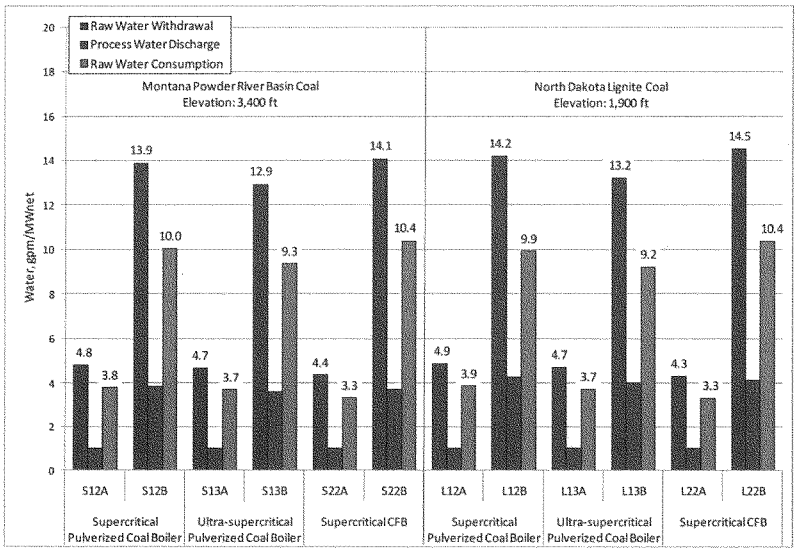

Figure 1-2. Summary of the Water Demand/Consumption for Various Coal-fired Plant Scenarios.

A number of efforts are being investigated to lower the water demand and water net consumption requirements for retrofitting existing plants and for new plants. These include:

(1) Use lower quality water resources instead of water sources that compete with agriculture (e.g., municipal water reclamation discharge water to lower raw water withdrawal by up to 50%;

(2) Air-cooled condensers or hybrid air/wet cooled condensers (cooling circuits). As shown in the Table 1-2 and Figure 1-2 show the major reduction in water demand due to deployment of air and hybrid cooling system compared to conventional water ('wet') cooling systems. Unfortunately, the cost of a hybrid system is twice that of a wet system and the air cooling system is 3-4 times that of a conventional wet cooling system, dependent on the temperature and humidity conditions of the yearly plant seasonal cycle. Deployment progress and hence societal benefits are not forthcoming as the industry has substantial financial disincentives to implement beneficial low-water cooling systems due to New Source Review requirements that would impose additional investment expenses that exceed viable cash flow and investment recovery business conditions.

New coal-fired subcritical, SC PC or CFB plants with carbon capture (via Econamine) increases the water demand on a per MWe basis due to the increase in parasitic power. The amine process uses steam for the carbon capture, thereby increasing water demand. The CFB plants use in-bed sorbent SO_2 capture thereby eliminating the water requirements for the scrubbers or SDA.

WRI's concept of new oxy-combustion plants (PC or CFB) with natural gas combined cycle plant to supply the parasitic power can lower the water demand compared to PC plants alone with amine-based CO_2 capture. Additional research and development to further reduce water net consumption in coal, natural gas combined cycle, biomass, concentrated solar, and nuclear based power plants is needed for the longer-term economic sustainability and environmental health of the region and our country.

2. Much of the debate regarding the use of coal in our energy portfolio includes the release of heavy metal emissions. Your testimony suggests that mercury emissions from China's use of coal which are transported in the atmosphere and deposited in the United States. Could your coal drying technology offer an avenue to reduce such emissions cost-effectively?

The quick answer is, "Yes." Lowering mercury levels within low-rank coal prior to utilization in generating electric power, provides opportunities to save on capital costs to install mercury capture on all power plants and also saves recurring costs for operation, maintenance and safe disposal of captured mercury for each power plant. If substantial quantities of mercury are removed from the coal at the mine site, then it can be safely returned to whence it came when mine site reclamation occurs. This also lowers transportation costs of captured mercury since the drying plant is located adjacent to the mine.

Regarding mercury deposition in the western U.S., Chinese, and Asian, mercury emission sources are well documented in modeling and ground-based sampling. In an updated study on global mercury emissions to the atmosphere, N. Pirrone et al reported, "On an annual basis, natural sources account for 5207 Mg of mercury released to the global atmosphere, including the contribution from re-emission processes, which are emissions of previously deposited mercury originating from anthropogenic and natural sources, and primary emissions from natural sources." Regarding anthropogenic mercury emissions N. Pirrone et al reported, "Anthropogenic sources, which include large number of industrial point sources, are estimated to account for 2320 Mg of mercury emitted annually. The major contributors are from fossil-fuel fired power plants (810 $Mgyr^{-1}$), artisanal small scale gold mining (400 $Mgyr^{-1}$), non-ferrous metals manufacturing (310 $Mgyr^{-1}$), cement production (236 $Mgyr^{-1}$), waste disposal (187 $Mgyr^{-1}$), and caustic soda production (163 $Mgyr^{-1}$). Therefore, our current estimate of global mercury emissions suggests that the overall contribution from natural sources (primary emissions + re-emissions) and anthropogenic sources is nearly 7257 Mg per year[2]..."

The authors provide updated data to breakdown the mercury emissions which reveals that nearly 400 $Mgyr^{-1}$ of the 810 $Mgyr^{-1}$ annual global mercury emissions from stationary combustion is attributed to China (268 Mgyr-1) and India (124.6 $Mgyr^{-1}$) with North American accounting for 65.2 $Mgyr^{-1}$ of the 810.

According to the National Atmospheric Deposition Program, "Atmospheric lifetimes of elemental mercury are estimated to be up to two years, and as methyl mercury in the soils for decades." This allows non-U.S. mercury emissions to intermix in the atmosphere with significant amounts later depositing within the U.S. Figures 2-1 and 2-2 illustrate the change in measured mercury concentration from 2003 to 2011[3] within the U.S. A recent study by the Electric Power Research Institute (EPRI) assessed the annual mercury deposition within the U.S. by foreign sources. Figures 2-3 and 2-4 provide the results of this EPRI study and 2002 assessment to highlight the significance of increasing mercury deposition in the U.S. from foreign sources. Therefore, we see noteworthy environmental and health benefits for our country by exporting a low-mercury content coal to Asian countries.

[2] Although not broken out by the authors, it is recognized that re-emissions accounted for under natural mercury sources should attribute a portion of re-emissions to mercury that originated from anthropogenic sources.
[3] It is noted that some of the difference between 2003 and 2011 is related to the better monitoring measurement capabilities that have been deployed since 2003.

Western Research
INSTITUTE

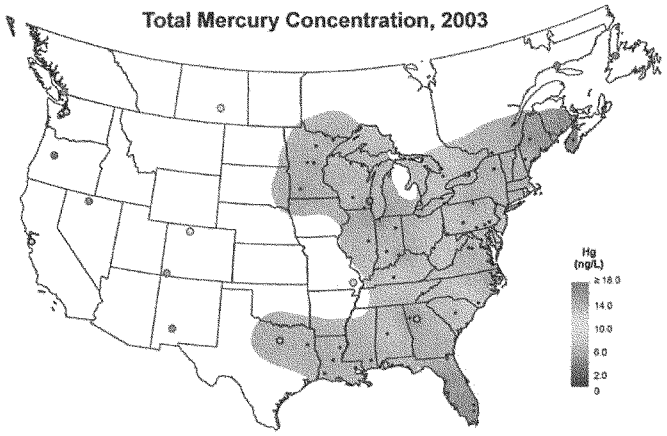

Figure 2-1. U.S. Mercury Concentration Map for 2003

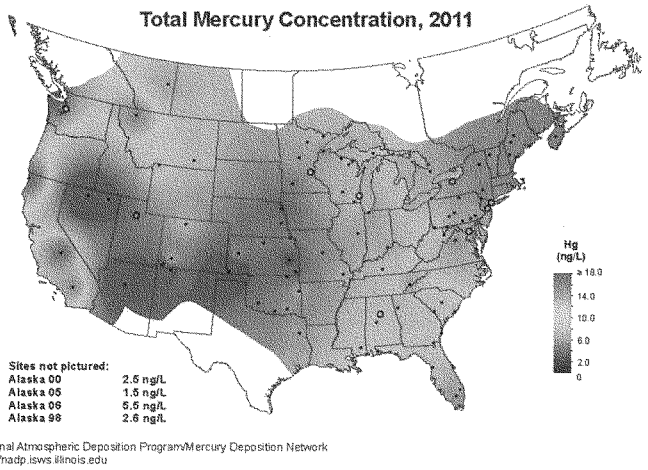

Figure 2-2. U.S. Mercury Concentration Map for 2011

Western Research
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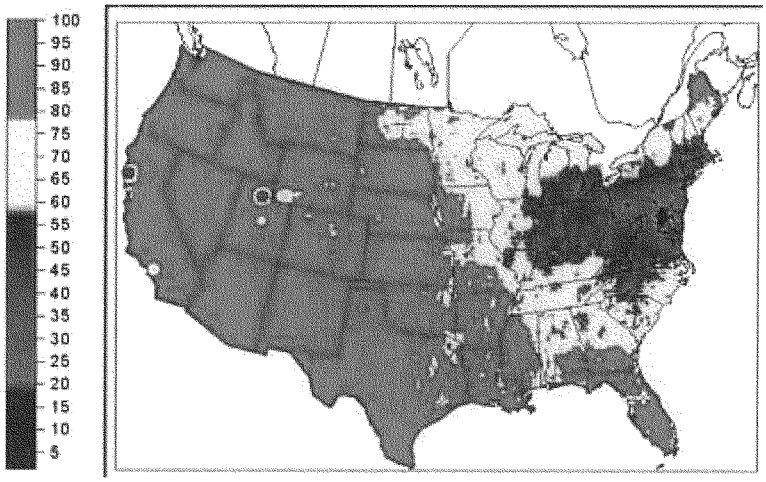


Figure 2-3. Mercury Emitted in China attributed Mercury Deposition in the U.S.

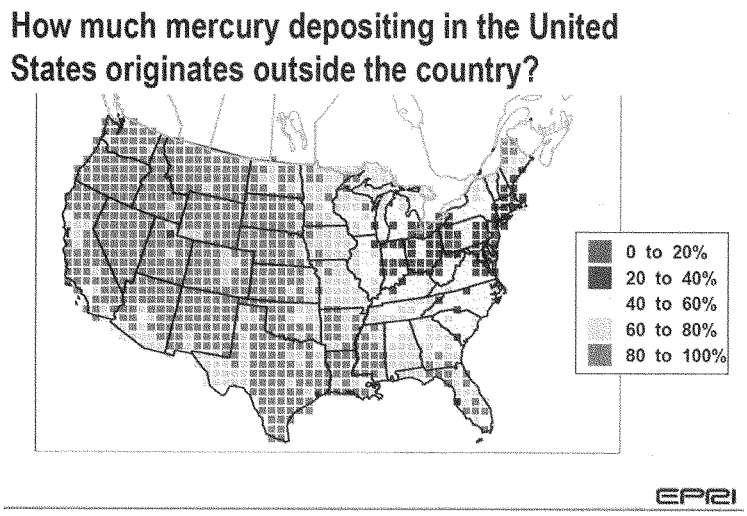


Figure 2-4. EPRI Foreign Sources of Mercury Deposition in the U.S. circa 2002[4]

[4] Source: Monroe and Levin, "Mercury Control a Utility Perspective", 2003 Advanced Combustion Engineering Research Center Conference

In essence there are two ways in which technology being developed by Western Research Institute that can assist in this issue. The first is the development of the WRITECoal™ process which we described in our written testimony. The WRITECoal™ process uses plant waste heat in large part to reduce water for plant use, remove approximately 75% of the mercury (Hg) from Powder River Basin coal, increase efficiency and lower the cost of electricity generated using U.S. low-rank coals. The WRITECoal™ process can perform equally well for the low-rank, high moisture coals in China. The process also reduces arsenic (As) emissions by up to 60% and selenium (Se) emissions by 20-40% from the utilization of low-rank coal for power generation.

The WRITECoal™ process is a power plant technology that reduces moisture to essentially zero (<1%) and provides substantial capture of trace metals (e.g., Hg, As, Se) prior to the coal entering the boiler and is implemented at the utility just prior to pulverization and injection into the combustor. The water delivered with the low-rank coal is also captured for later use to replenish the plant boiler feedwater. The moisture reduction and the metals are done in separate steps that allow for the production of clean water and the separation of metals in a dry atmosphere allowing high capture performance by sorbents. As such, WRI is working with groups in China as well as extensively in the U.S. to deploy the technology. Analysis of the costs have shown that as little as $10 increase of the price of delivered coal to the utility will increase the cost of electricity produced by 0.7 to 1.0 cents increase in electricity – a significant increase of 10-15% to rate payers in Wyoming and the U.S.

Another technology option to assist in reducing mercury emissions from utilization of coal in China and the resulting mercury deposition within the western U.S. is to partially dry low-rank coals and remove a large percentage of the mercury at the mine-site prior to exporting coal to China and other Asian countries. Western Research Institute is advancing one such technology with our industry partner, River Basin Energy (RBE). This mine-site technology was first developed to produce a higher energy coal for export. By adding metal capture technologies to the coal drying process, a substantial amount of the naturally occurring metals can be captured and safely returned to the mine during the site reclamation work to create wildlife habitat areas.

In this RBE process, the coal reabsorbs 6-8% moisture that helps reduce the tendency for spontaneous combustion allowing transport to the power plant. The costs of this process would increase the price by $9-11/ton of coal processed (FMI). The coal in the case of China would be shipped to ports in the northwest by rail trans-loaded and shipped overseas to China, trans-loaded to rail and shipped to their power plants. This coal in this scenario would be used for power instead of local Chinese coal resources. However, the costs of the rail to Northwest port, trans-loading to ship, ocean transport, trans-loading of the coal at entry into China, and rail to the power plant could be considerable, perhaps in the range of $30/ton above the raw coal price at the mine. In addition, the concept of exporting Wyoming coal to China though ports in the northwest has been met with resistance by environmental groups and the States of Washington, Oregon and California. Although we have not performed an extensive cost analysis, this rather large cost increment could be unacceptable for China power.

The export of PRB coal to China would most likely be used for higher valued applications, such as coal-to-liquids instead of power generation where the better quality, lower ash and reactive, PRB coals could be preferred over local coals for certain conversion processes and could entertain the higher coal prices.

Both of these scenarios should be of high priority and it is worthwhile to define the economics of these different approaches to the issue of mercury emission from Chinese sites that are atmospherically transported eastwardly and end up being deposited in the western U.S.

3. Your testimony discussed the need to develop integrated energy systems to live in a "carbon rich" world. Please elaborate on this point and explain how this approach can be integrated into the policy-making decision process.

Thank you for the opportunity to discuss further my thoughts concerning human contribution to global warming/climate change discussions, and policy solution approaches and possibilities. For more than several hundred million years, the circulation of carbon has been a key planetary aspect of our ecosystem. Integrating natural carbon circulation systems with increased anthropogenic activities is a multifaceted systems integration problem with many complexities and opportunities to affect sustainable energy and societal system solutions.

It is only relatively recent in terms of the planetary time scale following the Industrial Revolution that humans have understood and contemplated environmental stewardship and sustainable energy matters as knowledge of harmful natural resources and ramifications of anthropogenic activities has come forth; thanks in large part by the available of low cost electricity provided by coal. Coal-based electricity has supported numerous technological achievements and advanced medical treatments that have substantially extended human life expectancy.

The context for living in a "carbon rich" world is a growing global economy, an increasing population of middle class consumers, and a longer living population around the world. The context of the global economy provides system-wide sustainability challenges and hence opportunities to improve. It is reasonable to think that global population growth and the associated food consumption will increase anthropogenic contributions to global warming/climate change as human longevity and population growth increasingly change the historical natural planetary systems, including thermal energy and greenhouse gas equilibrium. Such change is an on-going reality unless humankind ceases development and population growth and/or devises sustainable solutions to recycle and reuse all resources. It is also reasonable to consider that pursuing policies to constrain life expectancy, food consumption, and quality of life to enable lowering global CO_2 emissions is not a tenable option.

Developing integrated energy systems within a sustainable global economy entails applying systems engineering methods that begin with setting the stage for stimulating numerous solution ideas by exploring and clarifying all aspects of the problem to then architect high-level system solution performance objectives. A key outcome is establishment of solution performance goals rather than defining specific ways to achieve the performance goals. The latter approach applied to policies constrains innovation and typical yields less effective solutions while inefficiently deploying financial and natural resources, and human talent.

Consideration of the various elements included in discussions on the contribution of humans in global warming/climate change necessitates considering that population growth itself is a key contributing factor to future heat (thermal energy) and CO_2 emissions. As a carbon-based life form, we convert food into chemical and thermal energy and CO_2 and other emissions. The food system within our global economy entails processes to produce, process, and transport food to population centers, and then to dispose of waste materials. To feed the world population, the food system consumes energy and adds

thermal energy and CO_2 into the atmosphere. Integrated energy system sustainable solutions should address the nexuses between energy, water and food, in addition to environmental concerns.

Conversation over the past few decades has evolved much conventional thinking aimed at pursuing a carbon-free or post-carbon world which in the extreme is not viable given that humans are in fact carbon-based life forms. This brings to light the need to explore thoughts and ideas outside of the conventional understanding and beliefs of what is needed and what is possible. A key to successful research and viable technologies is unconventional thought[5]. This includes the capacity for the research community to allow unconventional thought within itself and for society to allow thinking outside the blogosphere beliefs that constrain innovation pursuits. Highly effective systems integration and in turn policy is inhibited by such constraining beliefs and therefore requires proactive management of beliefs.

For example, there is reason to be concerned that use of survey polls that tally beliefs of groups of people and scientists to guide policy development undermines the integrity of the Scientific Method. The Scientific Method is a process through which a hypothesis or set of hypotheses are envisioned to in turn guide research activities aimed to bring forth knowledge to enable answering the questions that could not previously be answered. The integrity of this method is essential to determine whether or not a hypothesis was correct and can withstand the test of time such that quality policy options can be identified and implemented. Though scientists may believe that a hypothesis is likely to be proven true, there is great risk in making important policy decisions based upon a belief in an unproven hypothesis that entails significant known shortcomings rather than a proven and independently validated hypothesis. This is especially more vital when the belief is used to prescribe what solutions should be pursued and thereby constrain pursuit of alternative innovative solutions that could be more beneficial.

Pursuit of living in a "carbon constrained" world policy substantially constrains creative thought and innovative technological solutions that could achieve better sustainable energy and economic balance as the global economy continues to grow and increases consumption of energy as well as all natural resources.

If policies allow thinking and research on how best to live in the "carbon rich" world in which we live, then we can dramatically open the research community to pursue innovative ideas to achieve sustainable utilization of all forms of energy resources, recycle of energy, and use for energy conversion discharge compounds, including CO_2. A reasonable question to explore is, "Is it possible to recycle energy by thinking unconventionally and considering CO_2 as resource rather than a compound to be avoided?"

During the hearing, I found Congressman Massie's discussion about driving an electric car with batteries charged with electric from coal very interesting in that it provides an integrated systems solution nexus

[5] In his book "How to Think Like Einstein" author Scott Thorpe highlights the ability and need to think past conventional accepted beliefs to avoid constraining innovative thought progress and solution advancements such as Einstein did when he developed his revolution game changing concepts. The key point is to proactively understand when efforts are guided and constrained by beliefs and then to ask, "What if things were different than a belief suggests?"

between the power and transportation sectors to achieve a net reduction in anthropogenic heat and CO_2 emissions. In his story lies an integrated energy system policy opportunity to enhance the sustainability contributions of coal. Combined with utilization of coal power plant CO_2 emissions by chemoautotrophic bacteria discussed in my written testimony to produce synthetic diesel for the transportation sector coal-based electricity to charge electric car batteries provides a means to achieve greater national CO_2 emission reduction and increased energy security and sustainability.

Integrated energy system concepts should include other industry sectors to enable more efficient societal systems that produce and use energy and the co-products to form beneficial nexuses with other industry sectors and societal systems. Today this is not done well in our societal structures and rules. For example, the energy sector decoupling regulation of the past several decades while enabling certain innovations also hinders achieving benefits of integrated systems. In parts of the U.S., energy resource extraction, power generation and delivery elements within the energy sector are not allowed to communicate nor strategically plan and invest to improve system-wide efficiencies and realize associated environmental and economic benefits. The capacity to integrate across the entire energy sector is increasingly critical as environmental issues are addressed and global competition for energy resources is projected to accelerate.

As emerging and developing country economies grow from subsistence living to middle class life style consumption, we can anticipate increasing supply competition and shortages unless we devise effective recycle and reuse solutions for all resources, including energy. From an integrated systems thinking approach, it is vitally important to allow unconventional thinking and conversation to pursue solutions that can better serve our nation and planet compared to policy objectives that focus primarily on constraining CO_2 emissions. In addition, to scientific research and technology applied RD&D, we will need to work on regulation changes to enable integration opportunities across historically disconnected industry and societal sectors so that we can maximize societal efficiencies.

Appendix II

Additional Material for the Record

SUBMITTED LETTER FOR THE RECORD BY
SUBCOMMITTEE ON ENERGY CHAIRMAN CYNTHIA LUMMIS

Congress of the United States
Washington, DC 20515

July 22, 2013

The Honorable Barack Obama
The President
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Mr. President:

We are writing to express our grave concern about your intentions to implement New Source Performance Standards (NSPS) addressing greenhouse gas emissions for new and existing power plants as outlined in your June 25, 2013 speech at Georgetown University. Circumventing the will of Congress, which has repeatedly voted against carbon regulations, taxes, and cap and trade, this speech directs EPA to take the unprecedented step of imposing an energy tax by regulatory fiat. This catch-all proposal would unfairly penalize existing facilities and almost certainly preclude the construction of new coal-fired plants.

We and others have often criticized a "War on Coal" waged by this White House and these accusations were met with firm denial by Administration officials and environmentalist allies. However, given the cumulative impact of continued mining permit delays, EPA regulations, and your annual budgets' repeated proposed cuts to the Department of Energy's fossil energy research and development programs, it is hard to come to any conclusion other than that your Administration is systematically trying to eliminate the use of carbon fuels, particularly coal. More to the point, Mr. Daniel P. Schrag of the President's Council of Advisers on Science and Technology finally feels comfortable admitting: "Politically, the White House is hesitant to say they're having a war on coal. On the other hand, *a war on coal is exactly what's needed.*" This remark by a senior White House "expert" demonstrates that these policies are explicitly an attempt to drive coal from the marketplace.

Even before the announcement of the NSPS greenhouse gas rules, the harm inflicted by recent regulatory attacks on jobs and coal were clear. Rules such as Mercury and Air Toxics Standards have raised the cost of doing business in the electric utility industry by billions of dollars annually and mandated pollution control technologies that either do not exist or are commercially unviable. At a time of sustained high unemployment and a weak economic recovery, particularly in Appalachia and the former manufacturing hubs of the Rust Belt currently burdened with double-digit jobless rates, piling on billions of dollars in additional red tape further undermines our economy and weakens the long-term outlook for these communities. For example, between 2011 and 2012, Kentucky lost 5,700 coal jobs, 4,100 of which last year alone – a decline of 29.9%. According to your Administration's own figures, the number of coal mining jobs dropped by 3,300 in West Virginia in 2012. Statistics like these are repeated throughout our nation's coal-producing states. As dire as these numbers are, they cannot truly reflect the hardship confronting the proud, hardworking men and women who have been forced into the unemployment lines.

Sadly, Appalachia is not alone. Fully one-fifth of the nation's coal plants – 204 plants across 25 states – closed between 2009 and 2012. Seven EPA regulations proposed over the last four years will cost $16.7 billion annually once fully implemented. Power plants of any type are multiyear, multibillion dollar projects, and this onslaught of regulations will deter the investment in new facilities as older plants are retired and a recovering economy renews energy demand. The rate hikes attendant with the loss of 69,000 megawatts of coal-fired power are forecasted to cost 887,000 mining, utility, shipping, and downstream manufacturing across the country per year. The manufacturing sector, which was making a comeback due largely to affordable energy, will again be put at a cost disadvantage compared to foreign competitors.

Ultimately, these policies pose a challenge not only to our economy, but also to our national security. The United States has 250 years worth of domestic coal reserves at current consumption rates. These resources, combined with oil, natural gas, nuclear, and renewables could finally make the United States energy secure – a goal of every presidential Administration since Richard Nixon.

We ask that you stand with our constituents, our coal miners, and our coal communities by rejecting these proposed NSPS greenhouse gas regulations to reflect the true commercial realities of different fuel types and control technologies. Staying the present course will only prove disastrous: increasing unemployment, raising costs for American families and businesses, and reducing our energy security.

Sincerely,

Harold Rogers
Member of Congress

Shelley Moore Capito
Member of Congress

Nick J. Rahall, II
Member of Congress

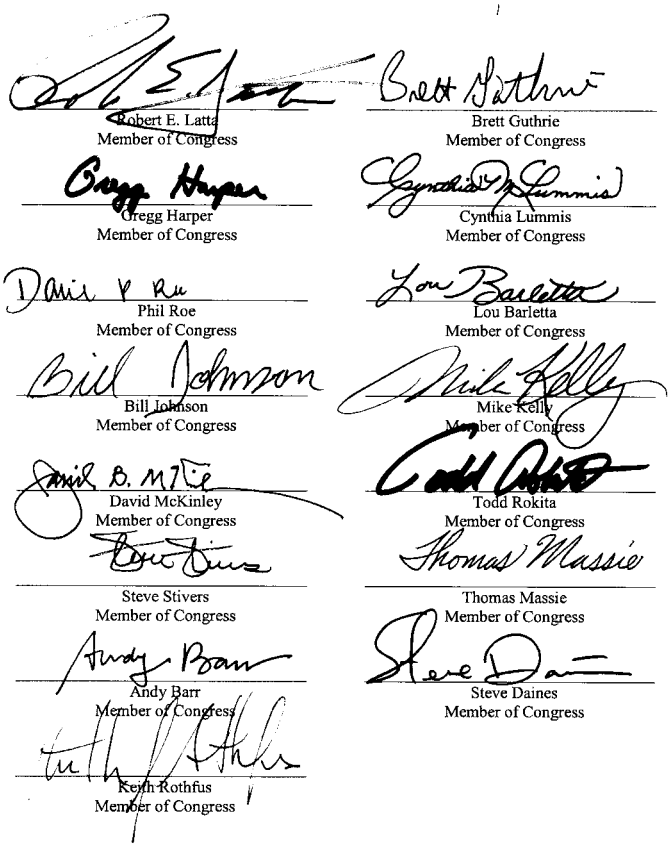
Robert Aderholt
Member of Congress

Mike Simpson
Member of Congress

Bill Shuster
Member of Congress

Jo Bonner
Member of Congress

John Carter
Member of Congress



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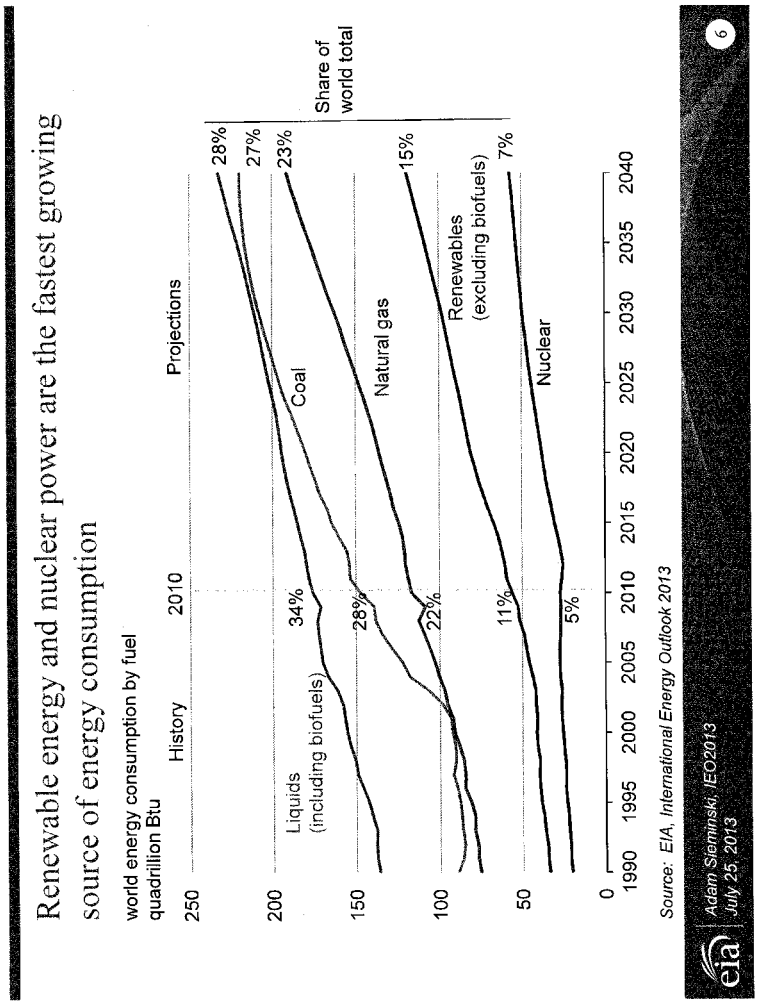
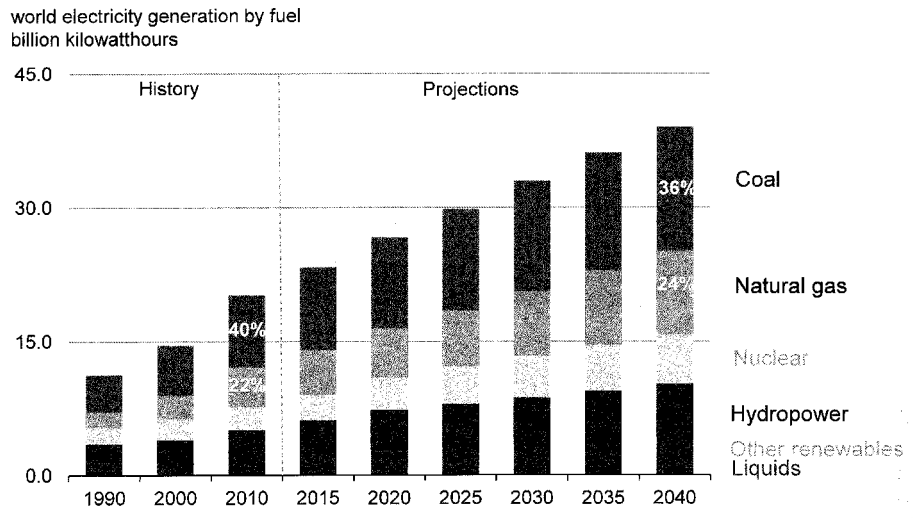
DEPARTMENT OF ENERGY'S INTERNATIONAL ENERGY OUTLOOK CHARTS
SUBMITTED FOR THE RECORD BY CHAIRMAN CYNTHIA LUMMIS



In electricity generation, renewables and natural gas are the fastest growing sources, but coal still fuels the largest share in 2040



Source: EIA, International Energy Outlook 2013

EPA POWER PLANT REGULATIONS: IS THE TECHNOLOGY READY?

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY &
SUBCOMMITTEE ON ENVIRONMENT

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

October 29, 2013

Serial No. 113–51

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October 29, 2013

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Appendix II: Additional Material for the Record

EPA POWER PLANT REGULATIONS: IS THE TECHNOLOGY READY?

TUESDAY, OCTOBER 29, 2013

HOUSE OF REPRESENTATIVES,
JOINT HEARING WITH THE SUBCOMMITTEE ON
ENVIRONMENT AND THE SUBCOMMITTEE ON ENERGY
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittees met, pursuant to call, at 10:07 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Chris Stewart [Chairman of the Subcommittee on Environment] presiding.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
2321 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515–6301
(202) 225–6371
www.science.house.gov

Subcommittee on Environment
and
Subcommittee on Energy

EPA's Power Plant Regulations: Is the Technology Ready?

Tuesday. October 29, 2013
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

The Honorable Charles McConnell, Executive Director, Energy & Environment Initiative, Rice University

Dr. Richard Bajura, Director, National Research Center for Coal and Energy, West Virginia University

Mr. Kurt Waltzer, Managing Director, The Clean Air Task Force

Mr. Roger Martella, Partner, Environmental Practice Group, Sidley Austin

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENVIRONMENT
SUBCOMMITTEE ON ENERGY

HEARING CHARTER

EPA Power Plant Regulations: Is the Technology Ready?

Tuesday, October 29, 2013
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

PURPOSE

The Subcommittees on Environment and Energy will hold a joint hearing entitled *EPA Power Plant Regulations: Is the Technology Ready?* on Tuesday, October 29th, at 10:00 a.m. in Room 2318 of the Rayburn House Office Building. The hearing will cover what considerations the EPA relied in making its selection of best system of emissions reductions in the proposed New Source Performance Standards (NSPS) for electric generating units (EGUs). In so doing, the hearing will explore the technological basis for concluding that carbon capture and storage (CCS) is adequately demonstrated as a technology for controlling carbon dioxide emissions in full-scale commercial power plants. Further, the hearing will examine whether the rule promotes or deters technological development and American leadership in energy technologies. Fundamentally, this hearing seeks to answer the question: Has CCS technology been "adequately demonstrated?"

WITNESS LIST

- **The Honorable Charles McConnell**, Executive Director, Energy & Environment Initiative, Rice University
- **Dr. Richard Bajura**, Director, National Research Center for Coal and Energy, West Virginia University
- **Mr. Kurt Waltzer**, Managing Director, The Clean Air Task Force
- **Mr. Roger Martella**, Partner, Environmental Practice Group, Sidley Austin LLP

BACKGROUND

Regulatory Context:

Section 111 of the Clean Air Act (CAA) establishes a unique technology-based mechanism for controlling emissions from stationary sources. Section 111(b) provides authority for EPA to

promulgate NSPS which apply to new and modified sources. Specifically, EPA is directed to set standards based on "the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."[1] In setting the standard EPA is given some flexibility in that "emission limits may be established either for equipment within a facility or for an entire facility."[2]

EPA first proposed a NSPS for emissions for carbon dioxide (CO2) from power plants in 2012. However, after more than 2.5 million comments on the original proposal, EPA decided that a new approach was warranted and rescinded the original proposal.[3]

Simultaneously, on September 20, 2013 Administrator Gina McCarthy announced EPA's re-proposed CO2 NSPS for new fossil fuel-based electric generating units (EGUs). "These proposed standards reflect separate determinations of the best system of emission reduction (BSER) adequately demonstrated for utility boilers and IGCC units and for natural gas-fired stationary combustion turbines."[4]

Under the proposal, EPA concluded that CCS has been adequately demonstrated as a technology for controlling CO2 emissions in full-scale commercial applications at coal-fired EGUs, while reaching the opposite conclusion—that CCS is not adequately demonstrated—in the case of gas-fired EGUs. Based on this determination, EPA proposed an emissions limit for coal-fired sources of 1,100 lbs of CO2 per mega-Watt-Hour (MWH) and proposed standards for natural gas combined cycle sources from 1,000 to 1,100 lbs CO2/MWH depending on the size and type of unit.[5] Electric Generating Units that primarily fire biomass are exempted from the proposed rule.[6]

In examining the regulatory impact, EPA asserted that "coal units built between now and 2020 would have CCS, even in the absence of this rule." In light of this modeling, "EPA projects that this proposed rule will result in negligible CO2 emissions changes, quantified benefits, and costs by 2022."[7] The proposal seeks comment.

Technical Background:

Carbon capture and storage (CCS) methods capture CO2 from fossil fuel combustion before it is released into the atmosphere and store it underground in geological formations. Unlike some emission control devices, CCS is not simply one piece of technology; it requires a system of coordinating elements for successful implementation. Broadly speaking, there are four links in the CCS chain: capture, compression, transportation, and storage. Each link in the chain poses separate and distinct challenges to the efficacy of the technology. Among these

[1] Clean Air Act § 111(a)(1), 42 USCA § 7411(a)(1) (2006).
[2] http://www2.epa.gov/sites/production/files/2013-09/documents/111background.pdf
[3] Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, Proposed Rule, Preamble p. 14-5, Sep. 20, 2013.
[4] *Id.* at 15.
[5] *Id.* at 15-6.
[6] *Id.* at 30, fn. 8.
[7] *Id.* at 16-7.

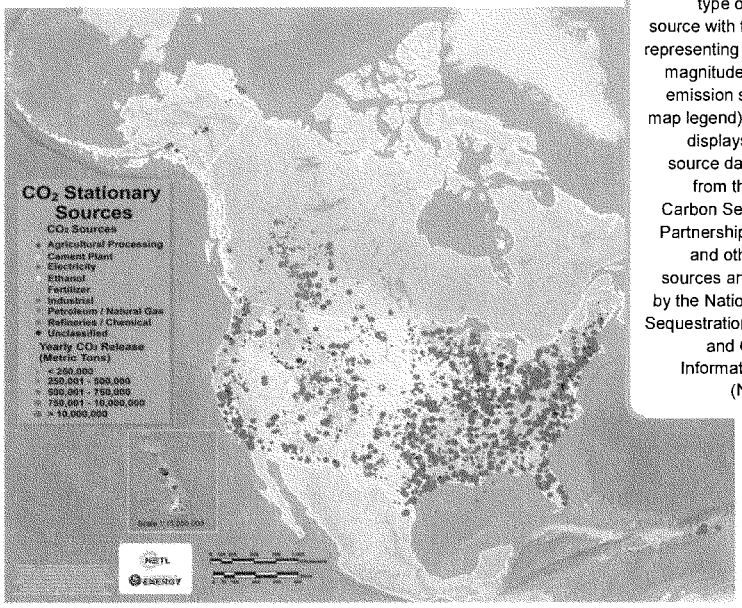
components, capture is the most technology-intensive and costly. Storage, on the other hand, poses the greatest liability and regulatory obstacles.

In the NSPS proposal, EPA notes four projects which—with significant governmental financial assistance—are designed to use some type of capture technology.[8] Although none of these projects have been completed, EPA anticipates at least one of these demonstration projects will be operational in the near future. EPA cites Southern Company's Kemper County Energy Facility in Mississippi, SaskPower's Boundry Dam CCS Project in Canada, The Texas Clean Energy Project in Odessa, and Hydrogen Energy California, LLC. Each of these projects, when completed, will utilize some elements of the CCS system EPA has selected in this proposal.

However, despite the promise of CCS technologies in power systems, currently there are no electric power plants operating with the CCS technology on a commercial scale.

CO_2 Sources

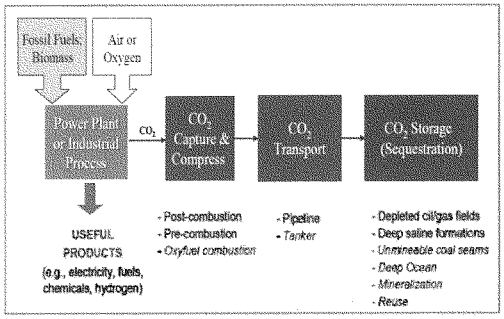
Where does CO2 come from? Nearly half of emissions come from mobile sources, like cars. But Stationary Sources also release CO2. Each colored dot represents a different type of stationary source with the dot size representing the relative magnitude of the CO_2 emission source (see map legend). This map displays stationary source data obtained from the Regional Carbon Sequestration Partnerships (RCSPs) and other external sources and compiled by the National Carbon Sequestration Database and Geographic Information System (NATCARB).



[8] EPA cites Southern Company's Kemper County Energy Facility, SaskPower's Boundry Dam CCS Project, Texas Clean Energy Project, and Hydrogen Energy California, LLC.

Capture

CO2 capture may be achieved through pre-combustion, post-combustion, or oxy-combustion technologies. **Pre-combustion** removal methods typically require the high-concentration of CO2 associated with expensive gasification systems. **Post-combustion**, on the other hand, utilizes nitrogen-based solvents to scrub the CO2 from the flue gas. However, because post-combustion capture requires substantial heat input to release the CO2 and regenerate the solvent, it results in significant reductions in overall plant efficiency and a substantial increase in cost. A third process, **oxy combustion**, requires expensive and energy intensive air separation units. While oxy systems hold promise, they are more experimental. Overall, while capture technologies exist, the new challenges associated with operating at a larger scale will not become clear until after full-scale deployment.



Source: E. S. Rubin, "Will Carbon Capture and Storage be Available in Time?" Proc. AAAS Annual Meeting, San Diego, CA, 18-22 February 2010, American Academy for the Advancement of Science, Washington, DC.

Compression & Transport

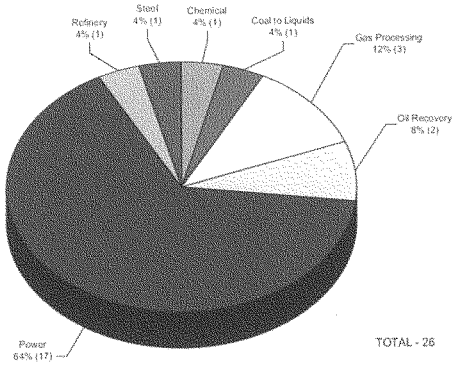
Once the CO2 is captured, it must be compressed. As with capture, compression is an energy intensive process. After compression, transportation to a storage site is required. Although dedicated CO2 pipelines have potential, technical challenges remain to ensure safe and reliable transport. Given the numerous policy and regulatory issues related to siting, permitting, and environmental requirements, creation of a full-scale CO2 pipeline infrastructure requires tremendous capital investment.

Storage

The critical final step in a CCS system is storage. However, permanently storing emissions is highly dependent on geologic systems. Geological storage is potentially available in deep saline formations, depleted oil fields, un-mineable coal seams, or for enhanced oil or gas recovery (EOR). However, lessons learned from failed storage sites in Africa demonstrate that maps of promising geologic formations do not always equate to locations where carbon storage can occur. Consequently, unresolved issues related to property rights acquisition, pore space management, regulatory structure, environmental protection issues, and liability remain a challenge. Significantly, EPA is unable to release operators from federal liability and litigation risk without legislative changes to existing environmental law.

Because of these challenges and the potential to offset the significant cost of CCS, the proposed rule focuses on the use of the captured CO2 for enhanced oil recovery (EOR). EOR has been used as a way to increase production in depleted oil fields by injecting CO2 into the oil deposit and pumping previously unrecoverable oil to surface. While EOR provides outstanding opportunities to increase oil production in some regions, many locations do not have access to an EOR market. Absent a robust EOR market, CO2 would simply be stored geologically.

According to the Global CCS Institute's 2013 report, seventeen (65 percent) of the 26 cancelled or delayed CCS projects are in power generation.



Future of CCS Demand:

As discussions of new climate strategies continue, pressure for additional CO2 restrictions will likely increase. Simultaneously, worldwide energy demand, particularly in emerging economies, is growing rapidly. Much of the current and future demand for energy will continue to be supplied by fossil fuels. Consequently, many projections suggest a strong long-term need for affordable technologies that can supply low-carbon energy from fossil fuels.

Additional Reading:

CONGRESSIONAL RESEARCH SERVICE, *Carbon Capture and Sequestration (CCS): A Primer*. July 16, 2013. Available at: http://www.crs.gov/pdfloader/R42532.

GLOBAL CCS INSTITUTE, *Global Status of CCS: 2013*. Oct. 10, 2013. Available at: http://www.globalccsinstitute.com/publications/global-status-ccs-2013/online/117741.

Hearing Charter, HOUSE SCIENCE, SPACE, AND TECHNOLOGY, SUBCOMMITTEE ON ENERGY AND ENVIRONMENT HEARING, *The Future of Coal: Utilizing America's Abundant Energy Resources*, July 25, 2013. Available at: http://science.house.gov/sites/republicans.science.house.gov/files/documents/HHRG-113-SY20-20130725-SD001%20.pdf.

U.S. ENVIRONMENTAL PROTECTION AGENCY, *Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units*. 40 CFR Part 60. Sep. 20, 2013. Available at: http://www2.epa.gov/carbon-pollution-standards/2013-proposed-carbon-pollution-standard-new-power-plants.

Chairman STEWART. The joint hearing of the Subcommittee on Environment and the Subcommittee on Energy will come to order.

Good morning, everyone. Welcome to today's joint hearing titled "EPA's Power Plant Regulations: Is the Technology Ready?" In front of each member are packets containing the written testimony, biographies and Truth in Testimony disclosures for today's witnesses.

Before we get started, since this is a joint hearing involving two Subcommittees, I want to explain how we will operate procedurally so that all Members understand how the question-and-answer period will be handled. After first recognizing the Chair and the Ranking Members of the Environment and Energy Subcommittees, we will recognize those Members present at the gavel in order of seniority of the full Committee, and those coming in after the gavel will be recognized in order of their arrival. And just as a side note, we had a Republican conference this morning, and that is going a little bit long. We expect other Members to be joining us shortly. And in the event that Ms. Lummis and others are not here for their opening comments, we will allow them to have that time allocated to them for their comments upon their arrival. I now recognize myself for five minutes for an opening statement.

I would like to thank the witnesses for being here today. I have had the chance to introduce myself and to meet you, and we appreciate your time and your sacrificing in attending with us, and we have an excellent panel before us, but I am disappointed EPA didn't accept our invitation to join us, and perhaps Ms. McCabe will be able to join us in the future hearing on this topic.

The significance of EPA's proposed New Source Performance Standards for new power plants simply can't be understated. As the first GHG standards for the statutory sources under the Clean Air Act, the rule does more than affect power plants. It sets the benchmark for standards affecting all industries, standards that will touch every aspect of our economy. Most troubling, however, is the proposal appears to be based on a hypothetical plant. This is a very dangerous precedent.

Under the Clean Air Act, setting the standards is basically a three-step process: first, establish the universe of adequately demonstrated technology; second, determine an achievable level based upon on that technology; and third, we consider the cost. In its proposal, EPA conveniently skips over step one. It then heavily focuses its analysis on modeling scenarios that project the answers to the steps two and three. These model-only-based arguments are outlandish to experts and engineers and to the general public. We don't need to look further than the botched-out rollout of healthcare.gov to appreciate the consequences of disregarding testing of a full-scale product. But EPA thinks it can get away with it due, primarily, I think to the court's deference.

But the focus of this hearing, and the first question the EPA must answer, is not what standards do we set or even is this cost-prohibitive? Instead, our hearing today focuses only on step one, and that is, is the technology ready? This question exposes the soft underbelly of the rule. When the facts and experts make clear the technology is not ready, there is no need to model emissions levels or ask economists to make projections.

To be clear, EPA relies on DOE modeling to conduct their analysis, and this is how they circumvent the step one "is it ready" question. They simply assume that it is ready and then they plow ahead. The model is only as good as the assumptions that go into it. Even a critical design review cannot account for irregular behavior in a full-scale product. Take, for example, the first Tacoma Narrows Bridge. Everything appeared to be operational until a 40-mile-an-hour wind toppled what was the third longest suspension bridge in the world.

Here, because the technology isn't ready, all of EPA's subsequent claims are purely hypothetical. Its claims are mere conjecture that ignores the fact that, in DOE's words, the technology is unproven.

After the Agency has finished looking into its crystal ball, analyzing an imaginary world, it tries to justify its claim of adequate demonstration with weak post hoc citations to cherry-picked literature, experiences with vastly scaled-down technology components and power plants that are under construction.

In order to comply with EPA's rule, carbon capture and sequestration is required. CCS, as it is commonly known, is not one piece of equipment; rather, is it a complicated system of many separate technologies. Each piece of this chain, which includes capture, compression, transportation and sequestration, must work in a seamlessly integrated fashion on a full-scale power plant. No CCS project in the world meets these criteria.

In its proposed rule, EPA points to several examples of fledgling CCS projects as proof that the technology is adequately demonstrated, but let us take a look at some of those examples. If you could look here to the screen, here are a few examples of the Texas Summit Clean Energy project, which in EPA's words is "under construction." My favorite picture, which is coming up, is at the project's web page, "small common grave by train tracks in Penwell." Actually, this is the only CCS currently occurring on the site.

Emissions modeling and economic projections based on a hypothetical plant are irrelevant. EPA's rule won't be implemented in a fairy tale world. This rule will affect real power plants and real people. This hearing is about what unicorns, Bigfoot, and the adequately demonstrated CCS for power plants all have in common: they are mere figments of the imagination.

Talk of emissions levels and cost based on a hypothetical modeling scenario is just a bunch of noise, a distraction from the fact that the technology isn't ready. EPA attempts to lawyer its way around this fact but ultimately, EPA cannot paper over the truth. To quote John Adams: "Facts are stubborn things."

I look forward to our experts' discussion today on this step one question: is the technology ready?

[The prepared statement of Mr. Stewart follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENVIRONMENT CHAIRMAN CHRIS STEWART

I would like to thank the witnesses for being here today. While we have an excellent panel before us, I am disappointed EPA didn't accept our invitation. Perhaps Ms. McCabe will be able to join us for a future hearing on this topic.

The significance of EPA's proposed New Source Performance Standards (NSPS) for new power plants cannot be understated. As the first GHG standards for stationary sources under the Clean Air Act, the rule does more than affect power plants. It sets the benchmark for standards affecting all industries—standards that will touch every aspect of our economy.

Most troubling, however, is the proposal appears to be based on a hypothetical plant. This is a dangerous precedent. Under the Clean Air Act, setting the standards is basically a three step process: First, establish the universe of "adequately demonstrated" technology. Second, determine an achievable level based on that technology. Third, consider the costs.In its proposal, EPA conveniently skips over step 1. It then heavily focuses its analysis on modeling scenarios that project the answers to the steps 2 and 3.

These model-only based arguments are outlandish to the experts, engineers and the public. We don't need to look further than the botched roll-out of healthcare.gov to appreciate the consequences of disregarding testing of a full scale product. But EPA thinks it can get away with it due to the court's deference.

But the focus of this hearing—the first question that EPA must answer—is not "what standards do we set?" or even "is this cost prohibitive?" Instead, our hearing today focuses on step 1: "is the technology ready?"

This question exposes the soft under-belly of the rule. When the facts and experts make clear the technology is not ready, there is no need to model emissions levels or ask economists to make projections.

To be clear, EPA relies on DOE modeling to conduct their analysis—that is how they circumvent the Step 1 "is it ready" question. They simply assume that it is and plow ahead. A model is only as good as the assumptions that go into it. Even a critical design review cannot account for anomalous behavior in a full scale product. Take for example the first Takoma Narrows Bridge. Everything appeared operational until a 40 mile-an-hour wind toppled what was the third longest suspension bridge in the world.

Here, because the technology isn't ready, all of EPA's subsequent claims—are hypothetical. Its claims are mere conjecture that ignores the fact that, in DOE's words, the technology is "unproven."

After the Agency is done looking into its crystal ball, analyzing an imaginary world, it tries to justify its claim of "adequate demonstration" with post hoc citations to cherry-picked literature, experience with vastly scaled down technology "components," and power plants "under construction."

In order to comply with EPA's rule, carbon capture and sequestration (CCS) is required. CCS, as it is commonly known, is not one piece of equipment; rather, is it a complicated system of many separate technologies. Each piece of this chain, which includes capture, compression, transportation and sequestration, must work in a seamlessly integrated fashion on a full scale power plant. No CCS project in the world meets these criteria.

In its proposed rule, EPA points to several examples of fledgling CCS projects as proof that the technology is adequately demonstrated. Let's take a look at one of those examples.

Here are a few pictures of the Texas Summit Clean Energy project, which in EPA's words is "under construction.

My favorite picture is at the bottom of the Project's web page—"Small common grave by train tracks in Penwell."

Actually, that is the only CCS currently occurring at the site.

Emissions modeling and economic projections based on a hypothetical plant are irrelevant. EPA's rule won't be implemented in a fairy tale world. This rule will affect real power plants and real people. This hearing is about what Unicorns, Bigfoot, and "adequately demonstrated" CCS for power plants all have in common—they are figments of the imagination.

Talk of emissions levels and cost based on a hypothetical modeling scenario is just a bunch of noise—a distraction from the fact that the technology isn't ready.

EPA attempts to "lawyer" its way around the facts. But ultimately, EPA cannot paper over the truth. To quote John Adams: "Facts are stubborn things; and whatever may be our wishes., our inclinations, or the dictates of our passion, they cannot alter the state of facts and evidence."

I look forward to our expert panel's discussion of this Step 1 question: Is the technology ready?

Chairman STEWART. With that, I now recognize the Ranking Member, Ms. Bonamici, for her opening statement.

Ms. BONAMICI. Thank you very much, Chairman Stewart and Chair Lummis, for holding this hearing today. And to our panel, welcome to the Committee on Science, Space, and Technology.

I join those who are very pleased by the proposal from the Administration and the United States Environmental Protection Agency to take the first steps to set carbon emission limits for all future natural gas and coal power plants. We have known for some time that dangerously high levels of carbon dioxide pollution are altering our planet's climate system. According to the latest statistics compiled by the EPA, American power plants released more than 2.4 billion tons of carbon dioxide into the environment in 2011. Fossil fuel power plants are responsible for a majority of these emissions, and coal-fired power plants emit more carbon dioxide than any other source.

Last month, the Intergovernmental Panel on Climate Change released the global comprehensive scientific assessment confirming that it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century. The report also confirmed that carbon dioxide increases are primarily the result of fossil fuel emissions, and have increased by 40 percent since the pre-industrial period. Addressing the effects of carbon pollution globally will require an international effort, but the United States can and must be a leader and set an example for other nations by reducing our own carbon pollution at home. We must do a better job of preventing the harmful effects of carbon dioxide emissions produced by natural gas and coal-fired power plants.

The coal industry's claim that the new carbon rule will kill jobs and bring down our recovering economy are scare tactics that have no basis in reality. The EPA proposal will not apply to existing power plants. The new rule will only apply to new coal-fired power plants that will be built in the future.

As we look forward to the EPA issuing the new carbon emissions standard, it is worth reminding ourselves of what we get with these standards: better air quality, which means better health for us, for our children, and for our grandchildren. In the four decades since it was signed, the Clean Air Act has saved thousands of lives and helped fuel job growth.

Additionally, and importantly, the passage of the Clean Air Act led to innovative advancements in technology. Environmental protection technology industries created innovations like catalytic converters, and sulfur dioxide and nitrogen oxide control technology. When the EPA took steps to require the application of these technologies, the industry made claims against those rules similar to the contentions that the coal industry is using today to undermine the carbon emission standard for new fossil fuel power plants: that our economy would be weakened and the industry would be devastated. And as we know, that did not come to fruition. Those industries adjusted and incorporated the technologies into their operations and went on to be more profitable than they had been, and we got cleaner air and healthier children.

The future of our planet and our environment depends on us making smart investments in innovative environmental protection technologies and reducing the amount of greenhouse gases we emit into our environment. The new EPA rule under the Clean Air Act will incentivize the development of these technologies that will in turn result in a safer, more secure and less carbon-dependent energy future.

And before I close, Mr. Chair, I want to clarify. It is my understanding that according to the EPA, they did offer to appear at a hearing in November. They were unable to appear today because once the government reopened after the shutdown which, as you know, lasted more than a couple weeks, they did not have enough time to prepare for today with the backlog from the shutdown. So I don't think they intended not to show; they did not get an invitation until September 27th, immediately before the shutdown.

So thank you, Mr. Chairman. I look forward to the testimony and answers to our questions, and I yield back.

[The prepared statement of Ms. Bonamici follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENVIRONMENT RANKING MEMBER SUZANNE BONAMICI

Thank you Chair Stewart and Chair Lummis, for holding this hearing today. And, to our panel of witnesses, welcome to the Committee on Science, Space, and Technology.

I join those who are very pleased by the proposal from the Administration and the United States Environmental Protection Agency to take the first steps to set carbon emission limits for all future natural gas and coal power plants. We have known for some time that dangerously high levels of carbon dioxide pollution are altering our planet's climate system. According to the latest statistics compiled by the EPA, American power plants released more than 2.4 billion tons of carbon dioxide into the environment in 2011. Fossil fuel power plants are responsible for a majority of these emissions, and coal-fired power plants emit more carbon dioxide than any other source.

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Chairman STEWART. Thank you, Ms. Bonamici, and regardless of the reasons why, we do look forward to subsequent conversations with the EPA, and we anticipate that they will be accommodating to us at that point.

The chair now recognizes the chairwoman of the Subcommittee on Energy, Ms. Lummis, for her opening statement.

Chairwoman LUMMIS. Thank you, Mr. Chairman and Ranking Member. Good morning, and thank you, witnesses, for joining us at today's hearing on carbon capture and storage technology. I do wish the EPA was here today, at least to listen to our concerns, and I consider an invitation extended on September 27th for a hearing that is occurring about a month later to be pretty good time to prepare, especially since it is their own rules that we are asking them to defend.

The EPA has proposed New Source Performance Standards for any future coal-fired power plant. These standards can be achieved only through the application of carbon capture and storage, a technology that is not currently in operation at a commercial-scale power plant anywhere in the world.

Instead of basing these requirements on technologies that are actually proven achievable on a commercial scale, EPA is redefining and stretching the requirement that technology be adequately demonstrated. This leaves many unanswered questions: Will the carbon capture technology function as intended when installed in full-scale plants? Is the pipeline infrastructure available for transportation on a large scale? And what is the liability for storage of carbon dioxide over the long term? EPA ignores many of these questions as the rule only impacts future coal plants.

The Obama Administration has spent much of the past few years casting coal as a villain. This regulation effectively bans the building of new coal plants, and fulfills President Obama's campaign promise to bankrupt coal companies.

But this hearing is not only about the proposed regulation. It is also about the legal precedent of mandating unproven technologies. The distinction the agency makes between coal and natural gas plants is dubious at best. By claiming that carbon capture technology is adequately demonstrated for coal, there is scant justification, legal or technical, for not requiring it for natural gas units. If EPA is allowed to twist the definition of "adequately demonstrated" to include yet-to-be-proven technologies for power plants, there is also little time—excuse me—there is also little to stop EPA from doing the same for other manufacturers like refiners, cement or steel plants. Not only would this throw our economy into a tailspin, it would force manufacturers to flee to countries with less restrictive environmental requirements, costing jobs and increasing global emissions.

Coal is our country's most abundant and affordable energy source. Thanks to the deployment of proven technologies, its pro-

duction is much safer and environmentally sound, and the Clean Air Act has worked. It has produced cleaner air every year since it was passed. Coal is not only our country's most abundant and affordable energy source, one that the President is making clear that his goal is to apply standards to existing plants as well, thereby making it difficult for existing plants to stay in business. This policy of picking winners and losers, of saying we are going to have wind and solar energy but not fossil fuel energy or nuclear energy, even though those are the only ones sufficient to create baseload, is reckless, and it is dangerous for our country if we want to advance economically and create jobs and return to a sound economy.

I continue to support an all-of-the-above energy policy, not one based on politics, and all of the above means all of the above including fossil fuel and including wind and solar.

From an economic outlook, none of this should be taken lightly. Affordable, reliable electricity is the backbone of a healthy economy. Rising electricity prices affect everything, the cost of basic commodities, like food to our competitive position in the world. And because increasing energy prices act are like a regressive tax, they hit the poor and those on fixed incomes the hardest. Just ask any single mother who pulls up to a gas station when the price of gasoline hovers near 4 bucks.

America cannot afford to allow EPA edicts to control our energy policy. These new regulations will make life harder for working families, for single moms struggling to get by, and for anyone who lives paycheck to paycheck. This is something we should be guarding against, not encouraging.

I look forward to the hearing. I look forward to this panel of witnesses. I want to hear you discuss the development of this technology, its potential as well as its limitations. I also want to understand the impact this rule could have on future advances in carbon capturing and also conversion of coal to liquids and other opportunities that create a cleaner future for our country while enjoying and utilizing our ingenuity and our abundant coal resources. If you really want to see whether somebody is affected by coal, I strongly encourage you to go out around 12:30 on the west front of the Capitol today. There is an American energy jobs rally. There are coal miners and the companies they serve here on the Capitol steps, and if you think that it is not going to matter or whether you can pass regulations that the technology is unproven but will suddenly appear and the prices that won't go up and that coal plants will continue to be built and those jobs will still exist, try listening to the people on the Capitol steps here today who will prove you wrong with their real-life stories.

Thank you very much, Mr. Chairman. I yield back the balance of my time.

[The prepared statement of Mrs. Lummis follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENERGY CHAIRMAN CYNTHIA LUMMIS

Good morning and thank you for joining us for today's hearing on Carbon Capture and Storage Technology.

The EPA has proposed New Source Performance Standards (NSPS) for any future coal fired power plants. These standards can be achieved only through the applica-

tion of Carbon Capture and Storage (CCS)—a technology that is not currently in operation at a commercial scale power plant anywhere in the world.

Instead of basing these requirements on technologies that are actually proven achievable on a commercial scale, EPA is redefining and stretching the requirement that technology be "adequately demonstrated." This leaves many unanswered questions: will the installment of carbon capture technology be functional? Are there plans for transportation on a large scale basis? What is the liability for storage of carbon dioxide over the long-term?

EPA would like Congress oversight of these standards to include only its impact on future coal plants. The Obama Administration has spent much of the past few years casting coal as a villain. This regulation effectively bans the building of new coal plants, and fulfills President Obama's campaign promise to "bankrupt" coal companies.

But this hearing is not only about the proposed regulation. It is also about the legal precedent of mandating unproven technologies. The distinction the agency makes between coal and natural gas plants is dubious at best. By claiming that carbon capture technology is adequately demonstrated for coal, there is scant justification—legal or technical—for not requiring it for natural gas units.

If EPA is allowed to twist the definition of "adequately demonstrated" to include yet-to-be-proven technologies for power plants, there is also little to stop EPA from doing the same for other manufacturers like refiners, cement or steel plants. Not only would this throw our economy into tail-spin, it would force manufacturers to flee to countries with less strict environmental requirements, costing jobs and increasing global emissions.

Coal is our country's most abundant and affordable energy sources. Thanks to the deployment of proven technologies, its production is safe and environmentally sound. The President has already made it clear that his goal is to apply these standards to existing plants as well. This policy of picking winners and losers through environmental regulations is reckless and dangerous. I continue to support an all-of-the-above energy policy, not one based purely on politics.

None of this should be taken lightly. Affordable, reliable electricity is the backbone of a healthy economy. Rising electricity prices affect everything—from the cost of basic commodities, like food—to our competitive position in the world. And because increasing energy prices act as a regressive tax, they hit the poor and those on fixed incomes the hardest.

America cannot afford to allow EPA edicts to control our energy policy. These new regulations will make life harder for working families, for single moms struggling to get by, and for anyone who lives paycheck to paycheck. This is something we should be guarding against, not encouraging.

I look forward to hearing the panel of witnesses discuss the development of this technology, its potential and limitations and the impact this rule could have on future advances. Thank you for joining us.

Chairman STEWART. Thank you, Ms. Lummis.

The Chairman now recognizes the Ranking Member of the Subcommittee on Energy, Mr. Swalwell, for his opening statement.

Mr. SWALWELL. Thank you, Chairman Stewart and Chairman Lummis, for holding this hearing, and I look forward to working with our witnesses today.

I do have to say, I think it is unfair, Mr. Chairman, to accuse the EPA of not accepting the invitation to be here today. That invitation was extended right before the shutdown and they have offered to appear in November. I look forward to having them here, but you can't turn off the power and then complain that no one answered the phone, and that is what I think is happening right here, and I think that is an unfair way to start this hearing.

Global climate change, though, is one of the greatest challenges that we face, and last month, the Intergovernmental Panel on Climate Change released a report which states with 95 percent certainty that human activities are responsible for climate change. This report was based on a rigorous review of thousands of scientific papers published by over 800 of the world's top scientists. The report also makes it clear that if we do not take steps to halt

this damage and make this change, the repercussions for humans and the environment will be catastrophic. We need to move forward and take the necessary steps to combat the warming of our planet before these impacts become inevitable.

We know that humans are impacting the climate in a number of ways, through emissions from the vehicles we drive, deforestation and changes in agricultural practices among other things. But fossil fuel-based power plants are the biggest producers of greenhouse gasses, accounting for roughly a third of our total emissions last year.

I have repeatedly said, just as Chairman Lummis has, that I favor an all-of-the-above approach to energy production. As I often say, if we can make it safe, let us make it happen. But I have to make it clear that we must take steps to make sure that we are reducing greenhouse gas emissions and lessening their impact on human health, the environment and global change.

That is exactly what the proposed standards for new coal and natural burning gases aim to do, which is why I support their implementation. And like Ms. Bonamici, I want to reinforce that they will have no effect on existing plants, so we aren't going to see a wave of shuttered plants and massive layoffs as a result of their implementation, and if we can display the first slide? Slide number one that is going to be displayed shows all of the existing coal plants in the United States, approximately 600 of them. Slide two is a map of the United States, and it has on it all of the plants that are affected by these new standards. You don't need a magnifying glass to see that the number is zero. Zero plants are affected by these standards. Zero jobs today will be lost by these new standards. And I think it is important not to confuse the issue here.

There are in-depth discussions underway about establishing standards for existing plants, which the EPA currently plans to propose next June, and there are ongoing, extensive engagement with all of the stakeholders to make sure that those standards will be flexible and won't have negative effects on state economies and job creation. I think we also cannot discount the value of certainty. The fact that there was uncertainty in what the regulations were going to be was also affecting job creation in existing plants and plans for new plants, and now that we have standards, that lends certainty to the marketplace.

Finally, there is nobody I know in Congress who intentionally wants to destroy or kill a job. I think what we want to do here is to make sure that we have healthy air for our children to breathe, a healthy future, and mitigate the effects on the economy to the best degree possible, but if you want to count job-killing by the numbers, the cost of the government shutdown for 16 days: 120,000 jobs, $24 billion to our economy. There is no policy that we can create today or that the EPA has created today that will kill as many jobs as that or wreak as much havoc on our economy as that government shutdown, and I think if we want to compare the two, that is a stark, stark contrast.

Finally, my colleagues on the other side of the aisle often say that our children and grandchildren will be left holding the bag if we do not reduce our deficits and national debt, and something I greatly agree with them about, but I think similarly, future genera-

tions will be the ones who will suffer if we do not take important and meaningful steps to confront climate change, but in this case, as the global scientific community has made clear again and again, the consequences of our inaction will be much, much more severe.

And with that, Mr. Chairman, I yield back the balance of my time.

[The prepared statement of Mr. Swalwell follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENERGY RANKING MEMBER ERIC SWALWELL

Thank you Chairman Stewart and Chairman Lummis for holding this hearing, and I also want to thank the witnesses for their testimony and for being here today.

Global climate change is one of the greatest challenges that we face. Last month, the Intergovernmental Panel on Climate Change released a report which states with 95 percent certainty that human activities are responsible for climate change. This report was based on a rigorous review of thousands of scientific papers published by over 800 of the world's top scientists. The report also makes it clear that if we don't take steps to halt this change, the repercussions for humans and the environment will be catastrophic. We now need move forward and take the necessary steps to combat the warming of our planet before these impacts become inevitable.

We know that humans are impacting the climate in a number of ways—through emissions from the vehicles we drive, deforestation, and changes in agricultural practices among other things. But fossil fuel-based power plants are the biggest producers of greenhouse gasses, accounting for roughly a third of our total emissions last year.

I have repeatedly said that I am for an "all of the above" approach to energy production as we transition to clean energy technologies. But I have also made it clear that, as part of this "all of the above" approach, we must take steps to ensure that we are reducing greenhouse gas emissions and lessening their impact on human health, the environment, and the global climate. That is exactly what the proposed standards for new coal and natural gas burning plants aim to do, which is why I support their implementation. And, like Ms. Bonamici, I want to reinforce that these are only proposed standards for any new plants that may be built and will have no effect on existing plants, so we aren't going to see a wave of shuttered plants and massive layoffs as a result of their implementation. There are in-depth discussions underway about establishing standards for existing plants, which the EPA currently plans to propose next June, and there is ongoing, extensive engagement with all stakeholders to make sure that those standards will be flexible and won't have negative effects on state economies and job creation.

It has been my hope that Congress would act on this issue immediately. Unfortunately, too many of my colleagues choose to ignore the scientific consensus that human beings are playing a significant role in the warming of our planet, so I'm not expecting that much will be done legislatively to sufficiently address this issue anytime soon. The President made it clear in his State of the Union Address back in January that, in the absence of Congressional action, his Administration was going to take the lead in efforts to reduce greenhouse gas emissions. These proposed standards reflect that commitment, and I fully support the President in this effort.

My colleagues on the other side of the aisle often say that our children and grandchildren are going to be left holding the bag if we don't reduce our deficits and the national debt, and I agree that it would be irresponsible of us not to take serious steps to put our fiscal house in order. Similarly, future generations will be the ones who will suffer if we don't take immediate and meaningful steps to confront climate change, but in this case—as the global scientific community has made clear again and again—the consequences of our inaction will be far more severe.

Chairman STEWART. Thank you, Mr. Swalwell.

Very quickly, we understand that there are differences of opinion and we can discuss or argue among ourselves whether the EPA had adequate time, some of us feel that they did, others may disagree with that. What is really clear is that in a pattern that has been established for more than just this hearing but for, frankly, for as long as I've sat in this chair, we have had to struggle to get them

to come and to participate in many of our hearings, and this is just another example of that. But as I said earlier, we look forward to working with them and getting their representatives to come and meet with us.

With that, we will now turn to the Chairman of the full Committee, Chairman Smith, for his opening statement.

Chairman SMITH. Thank you, Mr. Chairman.

Today's hearing will allow us to hear from top experts in energy and environmental fields and examine important technical issues associated with EPA's new power plant regulations.

In the regulatory process, it is often difficult to separate technical issues from legal issues, and the technology question we focus on here today is also ultimately a legal question.

If you take a look at the EPA's rule on air quality standards, the proposal looks more like a legal brief than a rule about protecting the air. It appears the EPA is up to an old legal trick: if you can't win the argument on the merits, start arguing about the definition of words.

In this proposal, the EPA redefines the law to accommodate its ever-expanding regulatory agenda. By redefining what the term "adequately demonstrated" means in the Clean Air Act, the EPA is making another major power grab, one that reaches well beyond coal. That is because the New Source Performance Standards for power plants is the first greenhouse gas standard under the Clean Air Act. Consequently, it sets the precedent for all other sources, and underpins everything from the price we pay at the pump to the cost of electricity and food.

If the EPA continues to play fast and loose with the law, we can expect to see more costly, heavy-handed rules that risk jobs and economic growth. Working families will bear these costs.

Even more troubling is the way this proposal appears to intentionally block the courts from reviewing the rule. By claiming that no one will build coal-fired power plants anyway, the EPA wants to prevent the courts from reviewing the rule on its merits.

Our founders recognized that elections alone may not provide adequate protection for the liberties they fought so hard to establish. They made sure that the Constitution provides a means for the American people to obtain a fair hearing before impartial judges. One of the most underrated rights Americans enjoy today may be the right to judicial review. This proposal is an attempt to prevent judicial review. Americans deserve to understand exactly what this proposal would do and retain the right to challenge it.

Thank you, Mr. Chairman. Before I yield back, let me apologize at the outset. I have another committee that is in the middle of marking up legislation that I will go to and another committee is also having a hearing, so I will be shuttling back and forth but appreciate your holding this hearing. It is a very, very important one. Yield back.

[The prepared statement of Mr. Smith follows:]

PREPARED STATEMENT OF FULL COMMITTEE CHAIRMAN LAMAR SMITH

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This proposal is an attempt to prevent Judicial Review. Americans deserve to understand exactly what this proposal would do and retain the right to challenge it.

Chairman STEWART. Thank you, Mr. Chairman, and you are welcome to participate as much as you can. Thank you.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF FULL COMMITTEE RANKING MEMBER EDDIE BERNICE JOHNSON

I want to thank Chairman Stewart and Chairwoman Lummis for holding this hearing to discuss the EPA's proposal to set national carbon emission limits for new natural gas and coal power plants. I also want to thank the witnesses for being here today to provide their input on this important topic.

The benefits from the Clean Air Act are countless; they come in the form of lives saved, reductions in illnesses, technological advancements in environmental protection, and economic growth. I join my colleagues Ms. Bonamici and Mr. Swalwell in expressing my approval of the Obama Administration's and the EPA's first steps toward protecting future generations from the harmful effects of carbon pollution that threatens our health and is changing our climate system. And, they are making those steps by advancing clean energy technologies. We would all prefer to address these important issues with common sense legislation, but until we can agree on both sides of the aisle that climate change is a real and pressing problem, bi-partisan collaboration on solutions does not appear to be possible.

Throughout history industry has often resisted addressing environmental problems that emerge as a result of a greater scientific understanding of our impact on the environment and our health. And, in many of these cases, they simply will not do so without regulatory intervention and proper government oversight. I challenge industry leaders to be a helpful partner in reducing our carbon emissions going forward. If they will, we can have both a cleaner environment and a strong economy.

Chairman STEWART. As our witnesses should know, spoken testimony is limited to five minutes, after which the Members of the

Committee have five minutes each to ask you questions, and your written testimony will also be included in the record of the hearing.

And I would like now to introduce our witnesses today, and I will introduce you individually. We will turn the time over to you for five minutes, then I will introduce the next witness.

Our first witness is the Hon. Charles McConnell, Executive Directive at the Energy and Environment Initiative, Rice University. Previously, Mr. McConnell served as the Assistant Secretary for Fossil Fuel at the U.S. Department of Energy. At DOE, he was responsible for the strategic policy, leadership, budgets, project management, research and development of the Department's coal, oil and gas and advanced technology programs, and the National Energy Laboratory's Technology Laboratory. Prior to joining DOE, Mr. McConnell served as Vice President of the Carbon Management at Battelle Energy Technology. And Mr. McConnell, we turn the time over to you now for five minutes for your opening statement.

TESTIMONY OF THE HON. CHARLES MCCONNELL,
EXECUTIVE DIRECTOR,
ENERGY & ENVIRONMENT INITIATIVE, RICE

Hon. MCCONNELL. Thank you. It is an honor to participate at this hearing and have the opportunity to have a fact-based discussion about the science of CCS technology. I might also add, it is refreshing to prepare my remarks today without any OMB oversight.

Let me start by saying that we do have a problem. CO_2 capture, utilization and storage technology is a requirement to meet greenhouse gas standards. It is a requirement to meet New Source Performance Standards, and it has not been commercially demonstrated at scale and cannot be deemed demonstrated technology.

CCS is an environmental solution. It is an energy security issue, and it is also about economic competitiveness. All three of these things contribute to our success as a Nation. CCS has the potential to make us stronger and more successful as long as we don't forfeit that potential by rushing deployment of a technology that is not yet ready.

The world is and will remain dependent for many decades to come on fossil fuels to provide low-cost, available and reliable energy. The International Energy Agency has already projected by 2050 the world's demand for energy will double. One point seven billion people in the world today live in energy poverty. And yet by 2050, because we will need every single megawatt, megatherm and energy source available to us, we will still have 85 percent of our energy in the world provided by fossil fuels. So having fossil technology isn't an option, it is a requirement, as is an all-of-the-above strategy.

Commercial CCS technology is not available to meet the EPA's proposed rule. The cost of capture technology is much too high to be commercially viable, much the same as the economic threshold similar to subsidized carbon-free alternatives such as solar, wind, et cetera. We are investing in all of the above across the board because it is critical to our future.

In June, the Administration released its Climate Action Plan, a comprehensive program of domestic GHG emission reductions. The President's plan can only be achieved through the broad deploy-

ment of low-cost, commercially viable technology for capturing and permanently and safely storing CO_2 from all fossil sources.

But it is about energy security as well. CCS is necessary to assure a sustainable, diversified domestic energy portfolio for our energy security. It enables a true all-of-the-above energy portfolio. It is also a business strategy. CCS, or CCUS, where the U means utilization of CO_2 for purposes such as enhanced oil recovery, create a marketplace for implementation of these applications. It leads to broad deployment and it also gives us a commercial and business background to bring that technology to the marketplace. CO_2 EOR has been practiced in this country for over 50 years very successfully, and it includes the safe, long-term permanent storage of CO_2. But as I said, the technology isn't ready yet. The technology exists for separation and capture of CO_2 at the plant but it increases the cost of generated electricity by as much as 50 to 80 percent, and that depends on the power plant or the industrial application in which it is being used. CO_2 pipeline and transmission systems are mature but they face incredible siting difficulties for expansion of this marketplace.

DOE's regional carbon sequestration partnerships must continue to develop the needed database to help analyze the success of this deployment, and of course, the injection of CO_2 faces regulatory barriers as well: unresolved property rights, long-term liability issues, all of the issues that in many cases the EPA is very involved in and needs to be supportive of to allow this technology to move forward.

But the technology is being demonstrated. It is successfully deployed in some early first-of-a-kind projects but it is clearly not ready. It is really that simple. Focusing other questions are hypothetical but not about the demonstrated results of these plants or projects or the technology associated with it. The technology can be made ready over time, and will have to have the support of the EPA as well as the marketplace and industry.

To summarize, in my opinion, it is disingenuous to state that the technology is ready, and at the same time, starve the R&D programs for our Nation's energy security, global competitiveness or our global leadership in terms of economic performance. Thank you.

[The prepared statement of Hon. McConnell follows:]

U.S. House of Representatives Committee on Science, Space, and Technology Subcommittees on Environment and Energy

EPA Power Plant Regulations:

Is the Technology Ready?

Oct 29, 2013 10:00 a.m.

The Honorable Charles D. McConnell
Executive Director, Energy and Environment Initiative (e2i)
Rice University

Thank you for the opportunity to address this very important topic.

Carbon Capture and Storage as well as Carbon Capture Utilization and Storage (CCS/CCUS) are critically important to our nation, and I am glad Members of Congress are taking the time to understand the state of today's technology. CCUS is both an environmental solution and an important component of a business strategy. It is a business strategy that allows companies to meet EPA greenhouse gas (GHG) regulations, increase domestic oil production, and create domestic jobs by means of CO_2-EOR. CCUS also is necessary to assure a diversified domestic energy portfolio for energy security. It also helps minimize future rapid escalations in electricity prices, allowing a real "All of the Above" energy portfolio that includes our most abundant domestic resources – clean fossil energy from coal, oil, and natural gas.

Studies have verified that implementation of CCUS technology is necessary to comply with EPA's proposed New Source Performance Standard (NSPS) regulation and meet the GHG targets necessary for limiting CO_2 emissions to our atmosphere. However, commercial CCUS technology currently is not available to meet EPA's proposed rule. The cost of current CO_2 capture technology is much too high to be commercially viable and places the technology at similar economic thresholds of alternative clean, carbon-free energy alternatives currently being subsidized.

CCUS is also necessary to achieve President Obama's June 25th Climate Action Plan, a comprehensive program of domestic GHG emission reductions, adaptation measures, and international activities to address climate change. Global climate change, as the name indicates,

must be addressed globally in order to make a difference. The world is and will remain dependent on fossil fuels for many decades to come to provide low cost, readily available and reliable energy.

The President's Plan can only be achieved through the broad global deployment of low cost, commercially viable technology for capturing and permanently and safely storing/utilizing CO_2 from all fossil energy sources. Technology exists for separation and capture of CO_2 at the plant, but it increases the cost of generated electricity by about 80%. CO_2 pipeline technology is mature, but can face siting issues. While injection of CO_2 into deep geologic storage formations is being evaluated, it has only been done successfully on a relatively small scale at a few sites around the globe. And the Department of Energy's (DOE) Regional Carbon Sequestration Partnerships are still developing the needed data base to help analyze the success of its deployment. Saline injection also faces regulatory barriers, such as liability for leakage extending 50 years beyond the time injection ceases, and unresolved property rights issues. CO_2 injection into oil bearing geologies for Enhanced Oil Recovery (EOR) has been practiced safely for over 50 years. Although the geologies are known to have permanence for storage, the long-term measurement, monitoring, and verification of these geologies has not been practiced for CO_2 storage.

DOE, in partnership with industry, is pursuing a research, development, and demonstration (RD&D) program to address all of these issues, especially CO_2 capture cost reduction, but affordable solutions may be decades away with the current level of funding and resultant R&D strategy. Moreover, the timing of retirement of existing coal-fired units, based on

age and regulatory pressures, and the modest amount of new domestic power plant capacity resulting in part from the weak economic recovery, could lead to further delays in commercializing this necessary technology in our country. Internationally, however, the drive to provide electricity to those in developing nations is in full force and the year-over-year demand for coal globally is up 20% due to the pressure to eliminate energy poverty.

The DOE's coal research and development funding levels must be increased to enable the pursuit of demonstration projects to move transformational, low cost CCUS technology from the laboratory to the commercial marketplace in a timely manner. The sequester and persistently low budget request numbers have resulted in cuts to coal R&D at rates significantly lower than other DOE programs. An additional $100 million per year directed at low-cost, transformational CCUS could enable the demonstration of commercially viable CO_2 capture technology within ten years. While a considerable amount of technical risk would be required to undertake a program with this short of a schedule, it can be done.

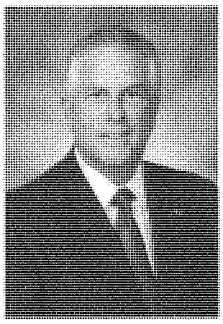
Such risk could be made manageable through the build-out of DOE's extensive scientific and engineering CCUS database, along with the scaling and system integration experience provided by the major CCS demonstration projects – such as the Kemper Project, scheduled to go on line in 2014.

These demonstration projects were funded with stimulus dollars. However, the stimulus dollars were focused on near term jobs creation and had associated "sunset clauses" not typically part of demonstration program funding. Sunset clauses force the demonstration of first of kind technologies on an "artificial" legislated schedule – not a schedule determined by the

management of risks associated with the scaling and integration of complex new technologies and the acquisition of financing for multi-billion dollar first-of-a-kind plants. While a large amount of stimulus monies were provided, they were sufficient to cover only about 20% or less of the costs of many of the major fossil/CCS/CCUS power plant demonstration projects. This required DOE's project partners to acquire billions of dollars in financing for technically and financially risky projects during a period that the U.S. was going through a deep recession – not easily done. This takes much time and effort to accomplish. The stimulus funding sunset provisions scheduled for September 2015 allow for very little time to secure such financing and many good projects could be lost as a result. The Congress may wish to consider extending the sunset provisions and also allowing DOE to transfer stimulus funding between ongoing projects to maximize success.

It is obvious that there is a need for continued funding as is defined by technologies that are not deemed to be "commercially available." To summarize, in my opinion, it is disingenuous to state that the technology is "ready" and it is wrong to underfund to assure failure if the true goal is "All of the Above."

Charles D. McConnell



Charles D. McConnell is Executive Director of Rice University's Energy and Environment Initiative, a university-wide integration of science, engineering, economic analysis, policy and social sciences to address the diverse issues and challenges associated with energy security, affordability and environmental sustainability. The effort is designed to partner with industry and external stakeholders and position Rice as an impartial broker that combines technology and policy to create a sustainable energy platform for excellence in resource utilization and environmental stewardship.

A 35-year veteran of the energy industry, McConnell joined Rice in August 2013 after serving two years as the Assistant Secretary of Energy at the U.S. Department of Energy.
At DOE, McConnell was responsible for the strategic policy leadership, budgets, project management, and research and development of the department's coal, oil and gas, and advanced technologies programs, as well as for the operations and management of the U.S. Strategic Petroleum Reserve and the National Energy Technologies Laboratories.

Prior to joining DOE, McConnell served as Vice President of Carbon Management at Battelle Energy Technology in Columbus, Ohio, where he was responsible for business and technology management, including leadership of the Midwest Regional Carbon Sequestration Partnership.

McConnell also spent 31 years with Praxair, Inc., providing business leadership and strategic planning to the global hydrogen business, refining and chemicals markets, enhanced oil recovery, carbon dioxide management and the full range of energy technology R&D activities.

McConnell has held a number of board positions including chairmanships of the Gasification Technologies Council and the Clean Carbon Technology Foundation of Texas. McConnell holds a bachelor's degree in chemical engineering from Carnegie-Mellon University (1977) and an MBA in finance from Cleveland State University (1984).

Chairman STEWART. Thank you, Mr. Secretary.

Our second witness today is Dr. Richard Bajura, Director of the National Research Center for Coal and Energy at West Virginia University. And Doctor, did I pronounce your name correctly?

Dr. BAJURA. Yes, sir.

Chairman STEWART. Thank you. He has spent the past 21 years facilitating research programs in energy at West Virginia University, and during this time he developed and managed eight major interdisciplinary and interinstitutional research programs addressing a wide range of energy applications from research extraction to alternative fuels. And Doctor, we turn the time over to you now.

TESTIMONY OF DR. RICHARD BAJURA,
DIRECTOR, NATIONAL RESEARCH CENTER
FOR COAL AND ENERGY, WEST VIRGINIA

Dr. BAJURA. Thank you, Mr. Chairman. Thank you for inviting me.

I consider coal to be a valuable resource and I believe we should maintain technology options to keep it as part of our energy future. As proposed, I think the EPA regulations will stifle coal's continued involvement.

I will summarize my comments in terms of lessons and observations that we have gained over the years of using coal technologies. Pulverized coal technologies are mature, integrating gasification and combined cycle technologies. There are only nine of them operating on coal in the world and only four in the United States. We have also learned that performance degrades with scale-up. What we learned in the laboratory doesn't always hold true when we go into the full-scale system. Many gremlins occur. Also, we have observed that delays in implementing projects, financing, technology costs and meeting schedules are important in determining the deployability of a technology.

The next topic deals with first-of-a-kind and nth-of-a-kind technologies. Over the years, we have developed what I will call learning-curve theory. What we find is the most expensive plant occurs on the first edition. By the time we get to the nth edition, the technology is mature and costs are reduced. Learning-curve technology for coal uses a factor that they call .06, which means that by the time you get to mature technology, you have reduced the cost by 25 percent. In the case of the Kemper plant, a $4 billion program, 25 percent reduction is $1 billion. Also in the case of Kemper, we are talking about $8,000 a kilowatt for the cost of the plant versus $1,000 a kilowatt for a natural gas combined cycle plant.

Coal is different from gas. Coal comes in three typical forms: bituminous, subbituminous and lignite. Natural gas, you can buy it anywhere. It is the same thing. Also, when you look at the deployment of technologies, what I learned on my technology is different from what you learn on your technologies. I don't share my results. As a result, while we might say we have different examples of technologies, they are almost first of a kind because they don't share the technology, they have different systems they apply to different coal. Technology integration is also important. We have to integrate a plant that has a new component with a pipeline, with a reservoir, and in many cases with the grid because we have to inte-

grate the up-and-down performance of coal plants that might need changed from baseload to intermittent or peaking time of the situation.

In terms of the demonstrations that we have talked about that relate to this hearing, there are nine demonstrations that are referenced. Three relate to chemicals production. Two are IGCC plants. One is them is based on the Kemper plant, which has not demonstrated, and the other one is a first of a kind as well. Saline aquifers are the kind of aquifers that I think we are looking at with future-gen deployments, and there is only one example of that, and that future-gen plant is not going to be onboard until 2017.

We have heard that capture technology is very expensive for coal plants. Capture technology for the most part is based on amines. We know that works. But these technologies were developed for chemical plants where the products that you sell can justify the extra cost they would need to use those technologies. It is very expensive for a standalone coal plant.

Also, we have issues concerned with legal and societal issues that also affect the cost of a plant and must be addressed. Cost and feasibility are not necessarily demonstrated. We can't find guarantees for the projects that we would want to put in place, and I am concerned with the legislation in the way it is proposed, it will stifle development and planning for new plants, and without a driver, there will be no technology developed. Our friends in China are very interested in developing coal-based technologies, they have strong government support and they are ahead of us in chemicals production, in power generation, and in their next five-year plan, they will be ahead of us in CCS deployment. We require strong Federal support to maintain coal's presence in the marketplace, and I believe Congress and the Federal Government and the Executive Branch should be more supportive of coal and maintaining it as part of our mix.

In summary, I don't think the technologies that we are discussing are ready for deployment in the sense of being fundable by financiers or getting guarantees. I believe that if we are not keeping coal in our future mix, we will run out of workforce. People like me are getting older. And I believe Federal support will help us to achieve the kind of goals that we want in introducing new technologies. Thank you.

[The prepared statement of Dr. Bajura follows:]

West Virginia University

Office of the Director
National Research Center For Coal and Energy
Richard A. Bajura

October 27, 2013

Representative Chris Stewart
Chairman
Representative Suzanne Bonamici
Ranking Member
Subcommittee on Environment
Committee on Science, Space
and Technology
U. S. House of Representatives
2321 Rayburn House Office Building
Washington, D. C. 20515-6301

Representative Cynthia Lummis
Chairman
Representative Eric Swalwell
Ranking Member
Subcommittee on Energy
Committee on Science, Space
and Technology
U. S. House of Representatives
2321 Rayburn House Office Building
Washington, D. C. 20515-6301

Testimony on

Technological Requirements for Meeting New Source Performance Standards (NSPS) for Emissions of Carbon Dioxide from Electric Generating Units (EGU)

Presented by
Richard A. Bajura
Director
National Research Center for Coal and Energy
West Virginia University

October 29, 2013

Members of the Subcommittees on Environment and Energy:

Thank you for the opportunity to offer testimony on the New Source Performance Standards (NSPS) being considered by the U. S. Environmental Protection Agency (EPA) under Section 111 of the Clean Air Act of 1970.

EPA identified the following key factors in their criteria for the proposed rulemaking:

- Feasibility – whether the system of emissions reduction is technically feasible
- Costs - whether the costs of the system are reasonable
- Size of the Emissions Reductions – amount of CO2 emissions reduction resulting from the system
- Technology Development – whether the system promotes implementation and further development of technology

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My testimony will focus on coal-fired electricity generation. Topics discussed are lessons learned about technology development, the stage of development of CCS (carbon capture and storage) technologies, technology development in other nations, and the need for federal support for research and demonstration projects.

Lessons Learned in Technology Development

Coal Plant Deployments and Performance

Thomas Sarkus of the National Energy Technology Laboratory (NETL) provided an overview of the U. S. Government's program in developing Clean Coal Technologies in a presentation at the 2013 Pittsburgh International Coal Conference. [1]

He noted that pulverized coal boilers were commercialized in the 1920s and 1930s, and that there are about 5,000 units operating world-wide with approximately 1,100 operating in the U. S. Fluidized bed coal combustion boilers were commercialized in the 1970s-1980s, and there are around 500 units operating world-wide with about 150, mostly small, units in the U.S. However, for Integrated Gasification Combined-Cycle (IGCC) coal power plants, there are only nine units operating world-wide and only four in the U. S.

He also shared his experience as a project manager for demonstration projects. He observed that technology performance often degrades with scale-up. In other words, a technology that looks promising in a small laboratory setting may not achieve the predicted operating performance at commercial scales. We often discover that new factors arise in larger systems that were not apparent in laboratory experiments. Also, project financing, cost of a system, and meeting construction schedules are all important considerations in determining if a technology is ready for commercial deployment.

First and N^{th} of a Kind Plants

In studying the development of technology for full scale systems that are deployed in large numbers such as the 5,000 pulverized coal plants referenced above, engineers have been able to quantify concepts that are called technology learning curves. Typically the highest cost for a full scale unit is the first of a kind (FOAK). As more copies of the same design are built and debugged, the performance of the design will generally improve and the cost for construction and operation will decrease. EPA is counting on the learning curve effect in making its projections for future performance and cost of CCS-based coal plants in establishing the proposed emissions limits on coal systems.

Care is needed, however, in in defining FOAK units and NOAK (N^{th} of a kind) units. Large scale units are usually based on a particular manufacturer's technology. Observations in the DOE/NETL-34/042211 report [2] illustrate the example that although gasification technologies are similar, it is unlikely that one vendor will share its experience with rivals. They comment that the E-Gas IGCC system (Conoco-Phillips technology) proposed for the Excelsior project is only a second of a kind

[1] Thomas Sarkus, Lessons Learned from U. S. Government Support of Clean Coal Technologies, International Pittsburgh Coal Conference, 2013, Beijing

[2] Quality Guidelines for Energy System Studies – Technology Learning Curve (FOAK and NOAK), DOE/NETL-341-042211, January, 2012 National Energy Technology Laboratory

IGCC based on the Wabash project experience. Little or no benefit will accrue to the E-Gas designers from the Pinion Pines (KRW technology) plant that failed, the Polk (GEE technology) in Florida, or the Buggenum and Puertollano (Shell) projects. Since the Excelsior project did not go forward to construction, of the nine IGCC plants cited by Sarkus above, it is possible they could all be FOAK plants. In this case, we would have only one, high-cost demonstration of each type that still has many major design parameters to be worked out to bring costs down and performance up to the values for an N^{th} of a kind plant.

We must also recognize that, unlike natural gas that is readily available nationally as a uniform commodity, coal varies from region to region in its characteristics. Coal power plants must be designed to accommodate the particular characteristics of the coal supplied. Hence, a large number of plants must be tested over a range of coals to bring a technology to a state of commercial readiness whereby a financial backer is willing to provide financing and a technology vendor is willing to guarantee system performance under penalty of paying the costs for operation of underperforming units.

Traditional pulverized coal plants have achieved demonstrated technology status. New designs such as ultra-supercritical systems or oxygen fired (oxyfuel) systems have not achieved that level of performance attainment given their relatively new introduction as a next-generation technology. Some of EPA's criteria in the NSPS proposal are based on only a FOAK system rather than a NOAK system. Experience has shown that FOAK systems are not commercially available and additional iterations on the technology are required to achieve commercial status.

Technology Integration

Technology learning curve theory also includes the proposition that some plants may have components of a technology that can be considered as N^{th} of a kind, but have critical components that are new and first of a kind. Hence, a pulverized coal technology plant that uses a new technology for carbon capture, such as a membrane, could be considered as a FOAK kind of a plant for the following reason. Control and operational problems usually have to be overcome due to the difficulties of integrating the new component with an older component that was not originally designed to be a good interface with advanced technology systems.

Integrating CCS with a power generation plant introduces complexities. The full system must be designed to handle contingencies that may occur. What if access to the carbon storage reservoir becomes unavailable - what happens to the CO2 captured? Alternatively, if the plant goes off line and the reservoir performance is based on continuous injection of CO2 to avoid damage to the long term performance of the reservoir, where does the plant or reservoir operator get the CO2 needed?

CO2 injection studies into geologic reservoirs have only been carried out at scales of tens of thousands of tons of CO2 per site. Larger scale studies are underway. For a full scale operating plant, a million tons of CO2 per year may be generated and would need to be injected to handle the plant's output. We need to validate geologic storage at this scale to prove out an integrated system with a CO2 capture plant. FutureGen, which is scheduled to be on line in 2017, will integrate the operation of the Meredosia plant with the storage reservoir operations. Integration of all components will be a challenge. This experiment will be a FOAK kind of plant in the context of the present discussion. Since this plant is still not in operation, we have not yet achieved a FOAK status with regard to developing a lessons learned notebook on demonstrating the technology.

Status of Carbon Capture Technologies

Many of the currently discussed post-combustion carbon capture technologies are based on the use of amines or chilled ammonia (recent technology developed by Alstom). The amine technology was originally developed for the chemical industry. In a chemicals plant, it is often necessary to remove CO2 from the process stream. Amine systems have high operating costs. Energy is required to disassociate the captured CO2 from the amine in order to use it again in the process stream. Chemical plants producing high value products can afford the extra expense since costs are recovered in the price of the product.

The price of the electricity is one of the lowest "value-added" components of a multi-product plant – i.e, for a polygeneration plant. Here fertilizer could be made, the captured CO2 sold for enhanced oil recovery (EOR) and process steam sold for district heating. Electricity is a smaller component of the overall outputs of the plant. The Summit and HECA plants referenced in the EPA proposal are plants of this type.

The cost of operating an amine technology for carbon capture in a stand-alone power plant is relatively more than in a chemicals plant. In a plant dedicated solely to generating electricity, the cost of using the traditional amine technology is generally summarized as:

- 45-70% increase in the cost of electricity
- 35-110% increase in capital costs
- 15-21% decrease in the plant's electricity output compared to operations before carbon capture equipment was added

While it has been demonstrated that carbon capture using amines will work technologically, this type of technology is not cost competitive for a stand-alone power generation plant as compared to a chemical refinery or a polygeneration plant. Using newer advanced technologies such as membranes or ionic liquids, or revised power cycles that minimize the steps required to separate and capture CO2 are ways to reduce costs. However, these are newer technologies that have not been demonstrated at commercial scales.

Legal and Social Issues

The large number of legal and social issues associated with developing a carbon sequestration site can delay construction and must be factored into the assessment of a technology's readiness for deployment. Data from many sources show that the cost of electricity from new natural gas plants would be low compared to new coal fired plants. Around 22% of the total cost of electricity for a natural gas combined-cycle plant is the capital cost, whereas capital costs could be as much as 50% of the total cost of electricity for a coal IGCC plant. Given the large fraction of a coal plant's cost that is tied up in debt service for financing and the long operating time over which payback may occur (typically 30-40 yeas), it is important that project construction occur on a timely basis. Otherwise, the increased cost of capital over the delay period would raise the cost of electricity even higher for the coal plant.

Practice has shown, however, that the following factors often add to cost increases that affect financing, technology development, and timeliness for the construction of coal plants:

- Regulatory Issues - permitting, treatment of CO2, ...

- Infrastructure Development – pipeline construction and permitting, ...
- Human Capital – need for developing a new workforce skilled in building and managing the equipment inside the plant boundary and handling the transport and storage of CO2 in the field, ...
- Legal Framework – liability for the CO2 once it is injected, ownership of the pore space under ground, ownership of the CO2 once injected, legal hassles between states over cross-boundary transport of CO2 underground, ...
- Public Acceptance – NIMBY → NUMBY perception by the general public
- Uncertainty – uncertainty about future legislation on CO2 emissions, ...

Carbon storage in geologic reservoirs must also overcome the concerns about injecting fluid into a space that is already crowded as compared to EOR injections. Using CO2 injection for enhanced oil recovery has been ongoing for a long time. In EOR, the injection of CO2 can be likened to re-pressurizing the reservoir to an original condition and thereby counterbalances the subsidence that could occur from removing the oil. For geologic storage in saline aquifers, the injection amounts to over-pressurizing the formation, promoting migration of fluids to other areas. This result generates more concerns than for EOR processes. These factors lead to delays in permitting and construction, and hence must be considered as a part of the cost and technical readiness of a technology. These issues have not been adequately resolved to attract power plant financers to invest money in projects with CCS.

Demonstration Status of CCS Technologies

The following comments address the theme of the present hearing, namely, has the commercial deployment of CCS technologies been "adequately demonstrated" to meet the key criteria of EPA cited above.

Feasibility

As noted above, the feasibility of using amine solutions for capturing CO2 has long been demonstrated in the chemicals industry. While technically feasible, the cost of the amine solution process is very expensive for power generation. The use of these amine solutions over extended duty cycles in coal gas atmospheres needs further development.

System integration issues are also a concern with regard to the operation of amine towers. The process works by trickling the solution down a wall that is exposed to the CO2 gas. Most chemical plants operate with one tower where instabilities in the falling film of amine caused by the upward rush of the CO2-laden air can be managed based on operating experience. For a large scale power plant, multiple amine towers will be required. Fluid flow instabilities in one tower can affect the operation of adjacent towers due to switching air flows in reaction to the tower upsets. This situation is one example of integration studies that need to be performed on large scale demonstration units before the technology can be said to be adequately demonstrated at commercial scale.

Coal-based IGCC systems have not been demonstrated in sufficient numbers as noted above, especially in carbon capture applications. Many of the examples cited in the EPA proposal have been for polygeneration systems. Additional research and demonstration is needed for stand-alone IGCC power generation systems.

Long-term storage of CO2 in geological reservoirs has not been demonstrated for large volumes of injected fluid on a continuous basis.

Cost

As noted above, costs associated with amine capture are high compared to costs that are expected to be realized when advanced carbon capture technologies come to fruition.

Additional costs are incurred due to the social and legal aspects of permitting a CCS power plant – storage field operation. These factors must be considered in assessing the cost of compliance with the 1,100 pounds of CO2 per megawatt hour standard proposed by EPA.

The latest pulverized coal plant that is an indication of the state of pulverized coal technology is the Turk plant, which is estimated to operate at a rate of 1,800 pounds of CO2 per megawatt hour. A significant cost and performance penalty will apply to reduce the emissions to 1,100 pounds per megawatt hour. Large scale operations of a coupled plant and storage system have not been operated sufficiently long to develop cost estimates of a combined operation.

The cost of using currently available carbon capture technologies is considered to be too expensive to be competitive for coal based systems.

Size of Emissions Reductions

Given the uncertainties associated with questions of feasibility and costs as noted above, it is likely that few if any coal plants will be deployed in the time frame proposed by EPA. Hence, the present proposal will not lead to significant reductions as stated by EPA.

However, if the proposal could be modified to delay the lower CO2 emissions requirement, there may be opportunities to propose new plants based on technologies that could be developed in the near future. Therefore, emissions reductions could result from a delay in implementing the standard.

Technology Development

As above, if no new plants would be built, there is no driver for developing technology for CO2 capture and storage. It is desirable to maintain a diverse portfolio of fuels to meet our energy needs. Programs that would encourage technology development are essential. Phasing in the standards over a longer time would provide a window for developing advanced technologies that could be demonstrated on a timely basis to achieve the goals of the EPA proposal.

Comments on Global Technology Development

The use of coal for power generation and chemicals production (liquid fuels, fertilizer, chemical products, ...) in China has passed the U. S. usages and the gap between the U. S. and China will continue to widen with respect to coal technologies.

Chinese planners have been willing to make investments in new technologies through support of fundamental and engineering scale research, and development of coal-based systems from large pilot plant operations to full scale development. These investments have been made by the government or by government-owned industries.

As a result, China has taken a leadership role in coal-to-chemicals and coal-to-liquid fuels production technologies, and is rapidly developing technologies for advanced power generation with coal systems and carbon storage. Their next Five Year plan will include a focus on government supported CCS activities, with active involvement in geological storage research and demonstrations.

Federal Support for Research and Demonstration Projects

The U. S. research and development program for coal-based technologies has made progress in developing advanced pulverized coal and gasification systems that include higher efficiency processes and carbon capture and storage applications. However, more progress needs to be made to achieve the goals proposed by EPA. A robust federal research, development and demonstration program is needed.

Advances in fundamental research in developing new materials, new control and integration technologies, and advanced cycles offer promise for higher efficiency in terms of power generation and in carbon capture and storage. Demonstration programs are more-or-less at the first of a kind status in developing ideas to the scale where their commercial viability and performance can be evaluated. In both of these areas, we need continued and strong support from Congress to ensure continued development of coal as a viable fuel for our nation.

Efficient coal technologies will ensure our energy and economic security by maintaining diversity in our portfolio of fuels. As a nation, we can show global leadership by developing and exporting technologies that address mounting concerns about carbon emissions. A risk we take by not acting in a strong leadership manner is that we will be buying our technology from other nations who are more aggressive in developing their technology base.

Closing Comments

Without the building of new plants, no technology advancement would occur to demonstrate the commercial readiness of new carbon capture and storage plants. Investments in a strong research, development and demonstration program, coupled with a delayed phase-in of the standards proposed by EPA would provide improved opportunities for technologists to meet the challenges proposed to us by EPA to improve our environment and economic competitiveness through advanced coal technologies. I recommend your consideration for both of these approaches.

Richard Bajura, Director
WVU National Research Center for Coal and Energy

For the past 28 years, Richard Bajura served in various roles facilitating, leading, and managing energy and environment programs in research and technical outreach at West Virginia University. During this time, he led seven major interdisciplinary - inter-institutional research programs and multiple WVU campus-wide interdisciplinary programs addressing a wide range of energy applications from resource extraction to alternative fuels. He is skilled at coordinating and managing research programs involving interdisciplinary groups of faculty members. As the Director of the NRCCE, he oversees a research enterprise with total annual budget averaging approximately $10 million. As an administrator, he has been instrumental in facilitating over $50 million in support for research faculty members at WVU. The NRCCE has developed financial and administrative management expertise to coordinate the efforts of faculty researchers working on joint programs.

In his earlier career as an active faculty member and researcher, Bajura's research interests included fluid dynamics and energy processes. His professional service included leadership in the Fluids Engineering Division of ASME where he also served as Vice President for the Basic Engineering Technical Group, representing one-sixth of the ASME membership and over 40% the Society's technical programs. He is currently active on the ASME Energy Committee, and is a member of the National Coal Council, the Coal Utilization Research Council (CURC), the Pittsburgh Coal Conference Advisory Board, and the Washington Coal Club Board of Directors. He is the Group Leader for the fuels program on the CURC Technical Committee for developing a technology road map for coal R & D programs. He serves as a technical program coordinator for WVU programs under the US-China Clean Energy Research Center.

January 2013

Chairman STEWART. Thank you, Dr. Bajura.

Our third witness is Mr. Kurt Waltzer, Managing Director at the Clean Air Task Force. In this role, he provides oversight and support of organizational management as well as ongoing development and implementation of organizational strategy. Mr. Waltzer has led the development of incentive policies for carbon capture that have been included in Federal legislative proposals and helped lead the NGO support for several carbon capture projects. Mr. Waltzer.

TESTIMONY OF MR. KURT WALTZER,
MANAGING DIRECTOR,
THE CLEAN AIR TASK FORCE

Mr. WALTZER. Chairman Stewart, Chairman Lummis and Ranking Members Swalwell and Bonamici, thank you for the opportunity to testify today. My name is Kurt Waltzer, and I am the Managing Director of the Clean Air Task Force, an environmental nonprofit dedicated to catalyzing the development and global deployment of low-carbon energy technologies.

First, let me explain why we believe CCS is needed. The world's power sector annual emissions are expected to double from 12 to 24 gigatons by mid-century. By 2015, China will have added 900 gigawatts of coal plants on top of our roughly 300 gigawatts of coal plants in the United States. India and other developing countries are following suit. Without significant CCS deployment, we simply will not be able to achieve the deep reductions in CO_2 emissions that are necessary to reduce the risk of catastrophic climate change.

Returning to the question in front of the Committee, CCS is technically feasible in the context of this rule because the rule requires partial, not full CCS, and because the rule allows a plant up to eight years to meet this standard. The 40 percent capture level is well within the experience of the technology. Moreover, if a plant intends to capture CO_2 on the day it opens and can't because of unforeseen issues with, for example,, completion of a CO_2 pipeline, the air compliance flexibility provision allows the plant to meet the standard over a longer time frame. The partial capture and sequestration requirement and flexibility provisions along with the ability to store CO_2 in conjunction with enhanced oil recovery, or EOR, helps ensure the rule can be met at reasonable cost, even before any Federal subsidies are considered.

CATF undertook an analysis of the initial NSPS rule first proposed in April of 2012. As we can see by figure one on page 8 of my testimony, the cost of electricity at a new coal plant that meets the partial CCS standard with EOR and takes advantage of the regulatory flexibility provision is only 13 percent higher than that of a new coal plant without CCS. CCS has been adequately demonstrated over its 40-year history in the United States. Since the 1970s and 1980s, large industrial plants have captured and stored large amounts of CO_2 on a per-plant basis up to 7 million tons per year. This experience is migrating to power plants. Nearly all new coal plants plan to have some level of CCS installed when they open. These include projects like the 582-megawatt Kemper plant in Mississippi, the Texas Clean Energy project and the Sask Power's coal retrofit project in Canada, known as Boundary Dam.

Each of the components of CCS have had a long history of use in the United States and around the world. Over 850 megatons of CO_2 have been stored underground in Texas for EOR operations over the last 30 years. There are currently 4,000 miles of CO_2 pipeline connecting CO_2 with enhanced oil recovery projects. Pre-combustion capture technology has been commercially available since the 1950s and 1960s with over 200 plant applications across the world, and post-combustion capture has been successfully applied to natural gas and coal plants with commercial guarantees offered from several vendors.

Does CATF also support incentives for CCS? Absolutely. Many technologies such as SO_2 scrubbers that have been deployed based on emission limits have continued to receive subsidies in order to make the technology more efficient and less costly. The EPA has long recognized that such subsidies are appropriately considered in evaluating the real cost of a standard. CATF is a member of the National EOR Initiative, an unusual coalition of advocacy groups, industry and labor organizations that are coming together in support of self-financing production tax credits for CO_2 EOR sourced by power plants and industrial sources.

I should note that in addition to EOR's value in reducing cost, it also provides significant potential scale. The National Energy Technology Laboratory estimates the technical potential to sequester CO_2 through EOR in the United States is as high as 80 million barrels, or 4 million barrels a day, and require 20 gigatons of CO_2. That represents about half of the total U.S. power sector emissions for the next 30 years.

We believe that EPA's rules on sound legal and technical footing is not the end of coal. Instead, it is the beginning of CCS worldwide.

I appreciate the opportunity to testify this morning and look forward to answering your questions.

[The prepared statement of Mr. Waltzer follows:]

BEFORE THE HOUSE SUBCOMMITTEE ON ENVIRONMENT AND THE SUBCOMMITTEE ON ENERGY OF THE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

TECHNOLOGIES TO MEET EPA'S PROPOSED NEW SOURCE PERFORMANCE STANDARD FOR CARBON DIOXIDE EMISSIONS FROM ELECTRIC GENERATING UNITS

TESTIMONY OF KURT WALTZER
MANAGING DIRECTOR
ON BEHALF OF THE CLEAN AIR TASK FORCE
OCTOBER 29TH, 2013

Chairman Stewart, Chairman Lummis and Ranking Members Swalwell and Bonamici, thank you for the opportunity to testify today. My name is Kurt Waltzer and I am the Managing Director of the Clean Air Task Force. The Clean Air Task Force is an environmental non-profit dedicated to catalyzing the development and global deployment of low carbon energy technologies, and other climate protective technologies, through research, public advocacy leadership, and partnerships with the private sector.

The purpose of this hearing is to explore the technological requirements of EPA's proposed New Source Performance Standard. Before addressing this topic specifically, I'd like to make some general points.

First, wide-scale deployment of CCS technology is vital to averting the worst aspects of climate change. Almost two-thirds of the roughly 30 gigatons of CO_2 emissions released from human activity can be addressed through CCS technology. That's because CCS can be applied to two key emissions sectors—power plants and large-scale industrial plants. My remarks today will focus on the power sectors, where global emissions from fossil fuel power plants total about 11.9Gt per year. If no action is taken, annual power plant emissions will nearly double (24 Gt) by 2050. In developing countries, new coal plants are being built at an astounding rate. By 2015, 900 GW of coal power plants will be in operation in China—three times the size of US fleet. The vast majority of these plants are new. The vast majority of these plants are new. It is extremely important to drive controls on these plants, in the US and abroad, because plants such as these regularly last for fifty years or more, and if such development occurs without any control, we simply will not be able to achieve the deep reductions in CO2 emissions that are necessary to reduce the risk of catastrophic climate change.

Second, wide-use of CO_2 captured from power and industrial plants is vital to driving expanded use of enhanced oil recovery (EOR) in the US that will increase US oil production and decrease dependence of foreign oil. EOR recovers oil from aging oil field by injecting CO_2 deep into oil formations. The CO_2 mixes with the oil, freeing it from tight pores in the rock, and moving it to producing wells. EOR currently accounts for about 6% of US oil production. But new estimates from DOE suggest that there is enough capacity in US oil fields to store half the CO_2 emissions from the power sector over the next 30 years. That would produce almost 80 billion barrels of oil, or about 4 million barrels a day, which is over 50% of current US oil production.

Third, despite what some in industry have said, EPA's proposed CO_2 NSPS regulations are not the end of coal, but the beginning of CCS. In examining the proposed EPA's rules, the committee should consider the flexibility in the rule's structure and implementation, and how the rule helps drive CCS technology adoption. The flexibility of the proposed rules includes these features:

- An emission limit of 1100 lbs/MWh that can be met through partial, rather than full CO_2 capture. Partial capture is less expensive to implement than full capture (90% or more) on power plants.

- The proposed rules allow up to eight years to meet the rule's emission standard. This flexibility has a profound and positive impact on new coal plants. It means that a new plant can go into operation and if delays with establishing storage sites or pipelines are encountered, the plant can continue to run.

So as the subcommittees consider the status of CCS to meet the proposed EPA standards, it's key to focus the discussion within the context of the proposed rule. The rule is based upon partial, not full capture. The rule provides ample flexibility to meet this standard. And as I will describe later, at today's low natural gas prices, it is unlikely that any form of new coal plant will be built in the next decade whether or not it has CCS controls. Taken together, EPA's proposed rule is clearly a "Best System of Emission Reduction" for new coal plants[1].

I'd like to turn now to the status of CCS technology.

Status of CCS Technology

Large, integrated CCS projects began in the United States in the 1970 and 1980s at industrial facilities[2] where CO_2 was sold for enhanced oil recovery (EOR). Some of these projects capture and store 1 million tons CO_2 per year, 5 million tons CO_2 per year, and 7 million tons of CO_2per year. From its beginning in industrial facilities, CCS has migrated to power plants where it can reduce CO_2 emissions by greater than 90%. This combined industrial and power plant experience is significant. In the US we have over 4,000 miles of existing CO_2 pipelines and 40 years worth of experience with injecting managing and ultimately geologically trapping nearly a billion tons of CO_2 due to CO_2 enhanced oil recovery.

Because the component pieces of what we call CCS systems have been in widespread and safe use, separately, for 40 years or more, they are more than adequately

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[1] section 111(a)(1) of the Clean Air Act (CAA) directs EPA to set standards of performance that: [R]eflect the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated. 42 U.S.C. § 7411(a)(1).

[2] These include Val Verde natural gas processing plant, Enid Fertilizer project, Shute Creek natural gas processing plant, Great Plains Synfuels plant, Century natural gas processing plant

demonstrated to form the basis for an emissions standard for power plant combustion of fossil fuels. Indeed, the component parts of CCS systems are not only "adequately demonstrated" they are commercially available.

The absence of a U.S. regulatory driver has hampered the expansion of this technology. It is hard to convince an investor to put money into controls that are not required, or to convince a utility commission to grant rate recovery for investment in pollution controls that aren't required. That is true even though the enormous potential for future carbon emissions reductions associated with CCS systems makes investment in these systems very cost-effective. We need these systems to be the norm in the future, if our country is to continue to generate electricity using coal. We are not talking about an expensive technology with only marginal benefits. Instead, simply put, CCS systems are the only currently available technology that can permit the use of coal and gas for the production of electricity, at *near zero* carbon – and conventional air pollution -- emissions levels.

The migration of CCS technology to the power sector has started, and with stronger regulatory drivers, this migration will accelerate. Key projects for coal CCS include:

- The Dakota Gasification Plant (a lignite coal to Synthetic Natural Gas plant) located in North Dakota has been using pre-combustion capture technology since 2000, capturing 90% of its emissions and shipping it to permanent EOR sequestration in oil fields in Canada. The plant converts 18,000 tpd of lignite to SNG using gasification technology, capturing 1.8 MT CO2/yr using Rectisol. The plant has been fully operational since 2000.

- In Kemper County Mississippi, Plant Radcliffe is a new 582 MW coal power plant currently under construction. When it opens in 2014, the plant will capture 65% of its CO2 and sequester them deep underground through EOR activity. The emissions from this plant are estimated at 550 lb/MWWh (gross).

- In Odessa Texas, the Texas Clean Energy Project (TCEP) is expected to break ground later this year. The 400 MW project will turn coal into base load power, and fertilizer, and will produce CO2 that will be sequestered deep underground through EOR activity. TCEP will capture over 90% of the CO2 it would otherwise emit. The carbon dioxide emission rate for this plant when it goes into operation in 2015 will be 228 lb/MWWh (gross).

- FutureGen 2.0 is an oxy-combustion plant that will use Babcock & Wilcox (B&W) and Air Liquide technology. The 200MW plant will capture 90% of its carbon dioxide resulting in 1 MT/yr CO2 captured, and will sequester all of that CO2 in deep saline (non oil-producing/non-EOR) geologic layers in the Mt. Simon formation. The plant is expected to come online mid-2016.

- Plant Barry, Alabama- This post-combustion capture demonstration captures a slip stream of about 150,000 tons of carbon dioxide per year which is injected in a saline formation about 16 miles from the plant.

- Boundary Dam, Saskatchewan, Canada (Sask Power)- This retrofit of capture and sequestration technology onto an existing 110 MW pulverized coal unit will capture 90% of its CO_2 (1 million tons per year) for EOR and saline permanent sequestration. Start-up of the CCS controls will begin in late 2013 and go into full operation in spring of 2014.

Clean Air Act Frame and Costs

The Clean Air Act's framework recognizes that new sources of air pollution are generally in the best position to integrate pollution controls into project designs and to invest in new pollution controls. That is why the statute takes a forward looking and technology forcing perspective on performance standards, and requires every 8 year reviews to accommodate advances in technologies that have occurred in response to the standards. This approach has been an important contributor to the fact that U.S. air quality has gotten consistently better throughout the 40 years since the statute was passed in its current form. And it remains true, for CCS technology, although the Sask Power retrofit also shows that where an existing unit can accommodate it, CCS retrofits on older plants also are possible.

As noted above the Act directs EPA to set allowable pollutant emissions rates/standards of performance that take into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements.[3]

The courts also have articulated this inquiry as ensuring that the costs imposed by the standard are not "greater than the industry could bear and survive" but instead are costs to which the industry can "adjust" in a "healthy economic fashion to the

[3] The D.C. Circuit has fleshed out this mandate through a series of cases decided across several decades. *See, e.g., Essex Chem. Corp. v. Ruckelshaus*, 486 F.2d 427 (D.C. Cir. 1973); *Nat'l Lime Assoc. v. EPA*, 627 F.2d 416 (D.C. Cir. 1980); *Lignite Energy Council v. EPA*, 198 F.3d 930 (D.C. Cir. 1999). For instance, the court in *Essex* held that the standard must be based on a system of pollution control that: [H]as been shown to be reasonably reliable, reasonably efficient, and which can reasonably be expected to serve the interests of pollution control *without becoming exorbitantly costly in an economic or environmental way*. 486 F.2d at 433 (emphasis added).

end sought by the Act as represented by the standards prescribed." *Portland Cement Assoc. v. Train*, 513 F.2d 506, 508 (D.C. Cir. 1975).

Thus, the statute requires EPA to balance the environmental and economic and energy related costs of requiring emissions rate-base performance standards. EPA is given a good deal of discretion to do this, although that discretion is not unbounded. The cost-effectiveness of any particular standard is particularly relevant to EPA's ultimate evaluation of whether the industry can bear the costs, as are questions about what the investment in new units in an industry looks like even before the standard has issued.

Here, the fact that CCS offers the opportunity for near zero emissions from coal generated electricity production, combined with the fact that the industry, as a matter of pure market economics, is now not investing in coal, are going to be significant factors. Courts have said that in situations like this, EPA's decision-making based on the future of the industry during the regulated period will be upheld. Additionally, EPA's past standards have required significant investments in controls representing, for example, 12 percent of the full investment in plant, and 5-7 percent annual operating cost increases, and in other instances 10s of billions ov dollars over a 20 year period, and have been upheld as reasonable given the pollution benefits to be achieved (and that we today benefit from). So, the relevant points in this inquiry are how much reduction in the pollution in question is available through application of the standard, and what the relevant price impacts of the standard will be where the industry is one that produces a commodity.

With this frame in mind, and to investigate the price impacts of partial CCS on a mid-western coal plant, CATF published a whitepaper in December, 2012 analyzing the potential cost of EPA's then-proposed 1000 pounds per megawatt hour standard for CO2, coupled with a longer time frame for compliance.[4] The analysis is based on cost estimates developed by NETL, but considers the flexibility mechanisms in terms of longer term compliance periods included in the initial proposed rule and as well as potential income from enhanced oil recovery. The current proposal also contains flexibilities, which are tied to the regulatory period of 8 years between review cycles for NSPS, whereas the original proposal included a 30 year averaging period for compliance, under which the CCS system needed to be operating in year 10. So, while our 2012 report is based on the 30 year

[4] "How Much Does CCS *Really* Cost? - An Analysis of Phased Investment in Partial CO_2 Capture and Storage for New Coal Power Plants in the United States", Clean Air Task Force, December 20, 2012. In its initial proposal, the Agency allowed for CCS phase in over a 30 year averaging period, wherein the partial capture and sequestration system did not need to be operational until year 10 of the plant's lifetime, and the emissions rate needed to be met over a 30 year annual averaging period. The current proposal also includes a longer time frame, which is tied directly to the "regulatory period" of 8 years between reviews.

averaging provision, it still requires immediate work on construction and near term operation of the CCS systems.

CATF's Modeled Cost Estimates Based on Performance Standard

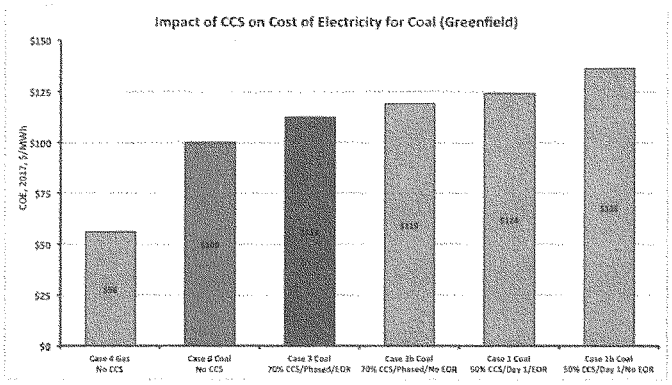
CATF published a whitepaper in December, 2012 analyzing the potential cost of EPA's first proposed NSPS rule from April, 2012[5]. The analysis is based on cost estimates developed by NETL, but considers the flexibility mechanisms included in the proposed rule as well as potential income from enhanced oil recovery. It's important to note these cost estimates included scenarios where developers delayed the installation of CCS for up to a decade, based on the proposed rule flexibility. Under the current proposed rule, developers would likely delay installation seven or eight years at most. Thus while the cost numbers will directionally stay the same, they may be somewhat higher than is outlined below. CATF will update this analysis based on the most recent proposal in the future.

The results are summarized in Figure 1 below. We found that the 2017 COE for a new natural gas combined cycle plant would be $56/MWh (Case 4), while that for a new supercritical coal power plant without CCS would be $100 per MWh (Case 0), and that for a new supercritical coal power plant with enough CCS to meet EPA's Day 1 standard would be $124 per MWh (Case 1, including revenue from sales of CO_2 for EOR). $124 per MWh represents roughly a 24% premium on the price of power the facility owner must charge in order to comply with the proposed Day 1 standard by using CCS, if it is assumed to get full rate recovery in the investment in the technology. If, however, the investment in CCS is delayed by 10 years, and the appropriate anticipatory work is done, a new supercritical coal power plant with CCS might be constructed which meets EPA's Phased standard for only $113 per MWh, representing only a 13% power price premium over the uncontrolled coal case (again after accounting for revenue associated with selling the CO2 for EOR sequestration).

For Case 1 (50% CCS from Day 1), without EOR
For Case 1 (50% CCS from Day 1) without EOR revenue the COE premium is 36% (versus 24% with EOR revenue). For Case 3 (70% CCS, Phased approach) without EOR revenue the COE premium rises is 19% (versus 13% with EOR revenue). These cases are labeled Case 1b and Case 3b, respectively in Table 2. Relative power costs for our primary cases are indicated in Figure 1 below.

[5] "How Much Does CCS *Really* Cost? - An Analysis of Phased Investment in Partial CO_2 Capture and Storage for New Coal Power Plants in the United States", Clean Air Task Force, December 20, 2012

Figure 1



Cost Relationship to NSPS

The Clean Air Act's framework recognizes that new sources of air pollution are generally in the best position to integrate pollution controls into project designs and to invest in new pollution controls. That is why the statute takes a forward looking and technology forcing perspective on performance standards, and requires every 8 year reviews to accommodate advances in technologies that have occurred in response to the standards. This approach has been an important contributor to the fact that U.S. air quality has gotten consistently better throughout the 40 years since the statute was passed in its current form. And it remains true, for CCS technology, although the Sask Power retrofit also shows that where an existing unit can accommodate it, CCS retrofits on older plants also are possible.

As noted above the Act directs EPA to set allowable pollutant emissions rates/standards of performance that take into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements[6].

[6] The D.C. Circuit has fleshed out this mandate through a series of cases decided across several decades. *See, e.g., Essex Chem. Corp. v. Ruckelshaus*, 486 F.2d 427 (D.C. Cir. 1973); *Nat'l Lime Assoc. v. EPA*, 627 F.2d 416 (D.C. Cir. 1980); *Lignite Energy Council v. EPA*, 198 F.3d 930 (D.C. Cir. 1999). For instance, the court in *Essex* held that the standard must be based on a system of pollution control that: [H]as been shown to be reasonably reliable, reasonably efficient, and which can reasonably be expected to serve the interests of pollution control *without becoming exorbitantly costly in an economic or environmental way*. 486 F.2d at 433 (emphasis added).

The D.C. Circuit has also articulated this inquiry as ensuring that the costs imposed by the standard are not "greater than the industry could bear and survive" but instead are costs to which the industry can "adjust" in a "healthy economic fashion to the end sought by the Act as represented by the standards prescribed." *Portland Cement Assoc. v. Train*, 513 F.2d 506, 508 (D.C. Cir. 1975).

Thus the statute requires EPA to balance the environmental and economic and energy related costs of requiring emissions rate-base performance standards. EPA is given a good deal of discretion to do this, although that discretion is not unbounded.

The cost-effectiveness of any particular standard is particularly relevant to EPA's ultimate evaluation of whether the industry can bear the costs, as are questions about what the investment in new units in an industry looks like even before the standard has issued. Here, the fact that CCS offers the opportunity for near zero emissions from coal generated electricity production, combined with the fact that the industry, as a matter of pure market economics, is now not investing in coal, are going to be significant factors. Courts have said that in situations like this, EPA's decision-making based on the future of the industry during the regulated period will be upheld. Additionally, EPA's past standards have required significant investments in controls representing, for example, 12 percent of the full investment in plant, and 5-7 percent annual operating cost increases, and in other instances 10s of billions ov dollars over a 20 year period, and have been upheld as reasonable given the pollution benefits to be achieved (and that we today benefit from). So, the relevant points in this inquiry are how much reduction in the pollution in question is available through application of the standard, and what the relevant price impacts of the standard will be where the industry is one that produces a commodity.

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[7] "How Much Does CCS *Really* Cost? - An Analysis of Phased Investment in Partial CO_2 Capture and Storage for New Coal Power Plants in the United States", Clean Air Task Force, December 20, 2012. In its initial proposal, the Agency allowed for CCS phase in over a 30 year averaging period, wherein the partial capture and sequestration system did not need to be operational until year 10 of the plant's lifetime, and the emissions rate needed to be met over a 30 year annual averaging period. The current proposal also includes a longer time frame, which is tied directly to the "regulatory period" of 8 years between reviews.

of 8 years between review cycles for NSPS, whereas the original proposal included a 30 year averaging period for compliance, under which the CCS system needed to be operating in year 10. So, while our 2012 report is based on the 30 year averaging provision, it still requires immediate work on construction and near term operation of the CCS systems.

Carbon Capture

CCS is demonstrated and available for use at new coal- (and gas-) fired power plants and its core processes (CO_2 capture, transportation and sequestration) have already been utilized at large scale.

Pre-combustion capture of CO_2 is the process by which CO_2 is removed from the syngas of a gasification plant so that the remainder is mostly hydrogen. A 2010 U.S. DOE database of gasification projects lists 125 individual coal gasifiers (and 2 petcoke gasifiers) at 19 commercial projects which are used to produce either ammonia, substitute natural gas (SNG), or gaseous feedstock for liquid fuels production.[8] All three of those processes (ammonia production, SNG, and liquid fuels production) entail significant amounts CO_2 capture as a part of a purification process of the industrial gas products. *The total thermal capacity of these projects exceeds 20,000 MW, and some have been operating for decades.*

As noted above, CO_2 captured at the Dakota Gasification project is transported by pipeline to Canada, where it is used for enhanced oil recovery (EOR) and sequestered (see more below). CO_2 from the Coffeyville project is currently vented, but reportedly agreements have been signed to transport the CO_2 to Oklahoma for EOR and sequestration.

Summit's TCEP coal IGCC project in Texas will also use Rectisol®, and it was the basis for the CO_2 emission limits in a May 7, 2012 Indiana Department of Environmental Management (IDEM) air quality permit for a proposed gasification plant in Rockport, Indiana that would manufacture substitute natural gas from coal.[9]

In the coal gasification to power process, the CO2 must results in elevated-hydrogen syngas, which must be burned in a combined cycle combustion turbine to produce electricity for sale. This change presents no unreasonable technical challenges to the turbine, however. By 2006 Siemens had already accumulated more than 750,000 hours of operation with elevated- hydrogen fuels in

[8] CATF analysis of DOE data. The DOE data is available at http://www.netl.doe.gov/technologies/coalpower/gasification/worlddatabase/index.html,.

[9] *See* Permit IDEM No. T147-30464-00060, Condition D.4.9 (Available at http://permits.air.idem.in.gov/30464p.pdf).

combustion turbines,[10] and GE had accumulated over 900,000 hours.[11] Another turbine and gasification vendor, MHI, also offers an IGCC with Selexol™ to achieve 60-65 percent CCS.[12] As a result, in their evaluation of high-hydrogen combustion turbines for the HECA IGCC project with 90 percent CCS, HEI determined that "commercial guarantees for F class turbines operating on high-hydrogen fuels would be likely."[13]

Post-combustion capture is based on aqueous solutions of amines (a family of nitrogen compounds similar to ammonia) that are commonly employed in industrial processes outside the power generation industry. These systems have been applied successfully to exhaust from natural gas (including a combined cycle power plant) and coal plants.

Table 1

Vendor	Location	Exhaust Stream	CO_2 Use
ABB	Searles Valley,	Coal Boiler	Chemicals Industry
ABB	Warrior Run, MD	Coal Boiler	Food Industry
ABB	Shady Point, OK	Coal Boiler	Food Industry
TPRI	Shanghai, PRC	Coal Boiler	Food Industry
TPRI	Beijing, PRC	Coal Boiler	Demonstration, Food
MHI	Kedah Darul Aman, Malaysia	NG fired SR flue gas*	Urea production
MHI	Aonla, India	NG fired SR flue gas*	Urea Production
MHI	Phulpur, India	NG fired SR flue gas*	Urea Production
MHI	Kakinada, India	NG fired SR flue gas*	Urea Production
MHI	Vijaipur, India	NG fired SR flue gas*	Urea Production
MHI	Bahrain	NG fired SR flue gas*	Urea Production
MHI	Phu My, Vietnam	NG fired SR flue gas*	Urea Production
MHI	Fukuoka, Japan	NG fired SR flue gas*	General use
MHI	Abu Dhabi , UAE	NG fired SR flue gas*	Urea Production
MHI	District Ghotoki,	NG fired SR flue gas*	Urea Production

[10] HEI, *HECA Feasibility Study Report #2 – Power Block Gas Turbine Selection* (May 29, 2009) (citing Brown, P., *Siemens Gas Turbine H2 Combustion for Low Carbon IGCC*, (Oct. 2007)).

[11] Shilling, N., Testimony of Norman Shillingon Behalf of Joint Petitioners in Cause No. 43144 Before the Indiana Utility Regulatory Commission (Oct. 24, 2006).

[12] Sakamoto, K., "Commercialization of IGCC/Gasification Technology for US Market", Oct. 7, 2008.

[13] HEI, *HECA Feasibility Study Report #2 – Power Block Gas Turbine Selection* (May 29, 2009).

MHI	Kedah Darul Aman, Malaysia	NG fired SR flue gas*	Urea production
MHI	Plant Barry, AL	Coal Boiler	Demo (amine)
Fluor	Bellingham, MA, USA	Gas Turbine Exhaust	Food Industry
Fluor	Lubbock, TX, USA	Natural Gas	Enhanced Oil
Fluor	Carlsbad, NM	Natural Gas	Enhanced Oil
Fluor	Santa Domingo, DR	Light Fuel Oil	Enhanced Oil
Fluor	Barranquilla, Columbia	Natural Gas	Food Industry
Fluor	Quito, Ecuador	Light Fuel Oil	Food Industry
Fluor	Brazil	NG / Heavy Fuel Oil	Food Industry
Fluor	Rio DeJanero, Brazil	Steam Reformer	Methanol Productio
Fluor	Sao Paulo, Brazil	Gas Engine Exhaust	Food Productio
Fluor	Argentina	Steam Reformer	Urea Plant Feed
Fluor	Spain	Gas Engine Exhaust	Food Industry
Fluor	Barcelona, Spain	Gas Engine Exhaust	Food Industry
Fluor	Bithor County, Romania	Heavy Fuel Oil	Food Industry
Fluor	Cairo, Egypt	Light Fuel Oil	Food Industry
Fluor	Israel	Heavy Oil Boiler	Food Industry
Fluor	Uttar Pradesh, India	NG Reformer Furnace	Urea Plant Feed
Fluor	Sechuan Province, PRC	NG Reformer Furnace	Urea Plant Feed
Fluor	Singapore	Steam Reformer	Food Industry
Fluor	San Fernando, Philippines	Light Fuel Oil	Food Industry
Fluor	Manila, Philippines	Light Fuel Oil	Food Industry
Fluor	Osaka, Japan	LPG	Demo Plant
Fluor	Yokosuka, Japan	Coal/Heavy Fuel Oil	Demo Plant

Fluor	Botany Australia	Natural Gas	Food Industry
Fluor	Alton, Australia	Natural Gas	Food Industry
Alstom	Mountaineer, WV	Coal Boiler	Demo (ammonia
Alstom	Mongstad, Norway	NG turbine/refinery	Demo (ammonia
Aker	Mongstad, Norway	NG turbine/refinery	Demo (amine)

All of these vendors above, except perhaps for ABB, offer commercial PCC systems for coal power projects. In fact, Fluor has said "[t]he Econamine FG+ technology is ready for full scale deployment in: Gas- and Coal-fired Power plants,"[14] and recent commercial activity supports their assertion. A January 2012 front-end engineering and design (FEED) study for Tenaska Trailblazer Partners LLC for a 760 MW (gross) pulverized coal power plant with 85 to 90 percent carbon capture to be located in Texas concluded that "Tenaska and Fluor achieved the goals of the [carbon capture plant] FEED study, resulting in ... establishment of performance guarantees which, after the addition of an appropriate margin, were consistent with the expected performance in Fluor's indicative bid."[56] Regarding their post-combustion CO_2 capture, technology, MHI says "[i]t must also be reinforced that MHI is NOW ready to provide large scale, single train commercial PCC plants for natural gas fired installations (with completed basic design for a 3,000 [tons per day] plant train) and intends to leverage this experience for application to large scale CO_2 capture for coal fired flue gas streams."

CO2 Pipelines

There are presently approximately 4000 miles of CO_2 pipeline connecting naturally mined and anthropogenic sources of CO_2 with enhanced oil recovery projects.[15] In total, this system now carries approximately 50 million metric tons per year of CO_2 throughput. The Denbury "Green" pipeline, completed in 2009, extends from Jackson MS to Houston TX, collecting and delivering both naturally mined and anthropogenic CO_2.

Based on IGCC and industrial coal gasification projects that were planned in the Ohio River Valley, Denbury had proposed 320-mile long extension of the Denbury Green pipeline to southern Illinois. While the CO_2-source projects failed to

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[14] Reddy, S., *Econamine FG Plus Technology for CO2 Capture at Coal-fired Power Plants* (August 2008).

[15] Advanced Resources International, *U.S. Oil production potential from accelerated deployment of carbon capture and storage* (2010) (Available at http://www.adv-res.com/pdf/v4ARI%20CCS-CO2-EOR%20whitepaper%20FINAL%204-2-10.pdf).

materialize (due to several factors including low gas prices and withdrawal of state support) the extension would have connected these Midwest anthropogenic sources to fields in Mississippi, Louisiana, and Texas. Advanced Resources Inc. has estimated that three 800 mile-long pipelines could result in the storage of 30 years of Ohio River Valley EGU coal plant CO_2.[16]

There are half a million miles of natural gas and hazardous liquids pipelines rights-of-way, of which some routes might also provide rights-of-way for the build-out of CO_2 pipeline network. Elliott and Celia (2012)[17] have analyzed the storage resources in the proximity of the largest U.S. CO_2 sources in the U.S. – they report that large sources emitting 2.2 Gigatons of CO_2 are located within 20 miles of a saline reservoir.

Geologic Storage

Decades of experience in enhanced oil recovery (EOR), wastewater injection, and natural gas storage, combined with very large geologic CO_2 storage capacities in the U.S., provide confidence that long term CO_2 storage is both available and a best system of emissions reductions (BSER).[18] While commercial-scale deep saline CO_2 injection and storage experience is more limited, deep geologic injections and storage of wastewater, natural gas and for enhanced oil recovery (EOR) are commonplace in the U.S. CO_2 injection technology is grounded in a half- century of oil industry CO_2 management expertise. Moreover, natural gas companies routinely use deep geologic storage for natural gas reserves at over 400 sites in the U.S. injecting and storing natural gas in saline aquifers, depleted natural gas reservoirs and salt deposits. Including geologic wastewater injections, billions of tons of fluids are injected each year in the U.S.[19] Capacities for deep geological storage of CO_2 amount to hundreds, if not thousands of years, of present day CO_2 emissions rates. The U.S. Department of Energy's North American Carbon Storage Atlas (NACSA) released in 2012 estimates that there are approximately 500 years

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[16] Kuuskraa, V., Advanced Resources International, *Challenges of implementing large-scale CO_2 enhanced oil recovery with carbon capture and storage* (2010) (Available at http://web.mit.edu/mitei/docs/reports/eor-css/kuuskraa.pdf).

[17] Elliot T.R. and Celia M.A., *Potential restrictions for CO2 sequestration sites due to shale and tight gas productioni,* 46 Environmental Science and Technology, 4223-4227 (2012).

[18] Benson, S., *Monitoring carbon dioxide sequestration in deep geological formations for inventory verification and carbon credits*, Society of Petroleum Engineers SPE paper 102833 (2006) (Available at http://www.energy.utah.gov/government/docs/forum/dec2006/spe102833.pdf).

[19] Wilson, E. *et al., Regulating the ultimate sink: managing the risks of CO2 storage*, 37 Environmental Sci. & Tech 3476-3483 (2003).

of storage capacity for CO_2 emissions in North America.[20] Geologic formations that can accept CO_2 are widespread in the U.S., particularly in states that are rich in coal reserves. This means that where power plants are built close to coal resources, they will also be proximal to deep geologic storage resources. Furthermore, substantial capacity and transportation and injection infrastructure are currently available in EOR fields in the parts of the Rocky Mountains, Midwest, Southeast and parts of California. Cooperative research in the western U.S. is wisely evaluating development of storage resources near existing CO_2 pipelines.

Seismicity

An MIT report from April 2012 assessed the availability of geologic storage in the U.S., taking into account both geology and the fluid mechanics of injected CO_2, concluded that CCS is a geologically viable climate change mitigation option and that CCS can play a "major role" within the portfolio of climate change mitigation options even when taking into account pressure limitations[21]. MIT's model-based assessment of storage capacity for CO_2 captured from the power sector serves to counterbalance some of the broad, poorly supported assertions concerning pore pressure-based limitations and related seismic risk of large scale CCS made by Zobrak and Gorelick in their June 2012 piece. Such pressure limitations were also identified as a potential – but unknown – risk factor for induced seismicity in the National Academy of Science's June 2012 Report entitled "Induced Seismicity Potential in Energy Technologies". The MIT Report's analysis demonstrates that ample storage capacities are available for current and future power sector CO_2 emissions, even taking into account the purported pore pressure limitations.

Unlike Zobrak and Gorelick's commentary, which based its analysis solely on the Illinois basin, the MIT Report's analysis is based on storage supply curves for 11 sedimentary basins across the U.S., utilizing a model that accounts for CO_2 migration and trapping physics during the injection and storage process. Exh. Supp-2 at 5186. The MIT Report estimates that pressure-limited storage capacity for existing and future fossil fuel-fired power plants (including coal and natural gas) in the eleven identified basins would be adequate to stabilize CO_2 production from power generation for a century or more. This will continue to be true even if fossil fueled energy production continues to increase at current rates. Moreover, and

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[20] Press Release: "Energy Department Announced New Mapping Initiative to Advance North American Carbon Storage Efforts" (May 1 2012) (Available at http://energy.gov/articles/energy- department-announces-new-mapping-initiative-advance-north-american-carbon-storage. The 2012 North American Carbon Storage Atlas is available at: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/NACSA2012.pdf.

[21] Szulczewslki, M., et al., Lifetime of Carbon Capture and Storage as a Climate-Change Technology, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES Vol. 109, No. 14, at 5185-89 (April 3, 2012).

significantly, the eleven basins identified in the MIT report do not make up the entirety of potential saline storage basins in the U.S. Because the MIT Report describes only the sequestration potential capacity in those eleven U.S. basins, it underestimates U.S. CO_2 storage potential, as it does not take into account either the capacity available in offshore geologic formations or from next generation EOR projects.

Storage Regulations

A national regulatory framework now exists to support a determination that CCS is the best system of emissions reduction for any industry using that technology, and that CCS will be deployed in an environmentally protective manner. In 2010, EPA established a well class specifically designed for the geologic sequestration of CO_2 under the Federal Underground Injection Control program (UIC). *Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells,* 75 Fed. Reg. 77,230 (December 10, 2010). These wells, deemed "Class VI" wells, are designed to ensure that injected CO_2 remains in a specified area and that CO_2 is properly monitored. EPA has also issued multiple guidance documents for Class VI wells that cover a variety of topics including, monitoring and testing, site characterization, area of review evaluation and corrective action, well construction, and financial responsibility.[22]

CO_2 sequestration may also concurrently occur in enhanced oil recovery (EOR) operations. UIC Class II injection permits are required for injections of CO_2 for EOR, and a process is available to obtain Class VI permit coverage for full-scale sequestration after oil production operations cease. *See* 40 C.F.R. §144.19 (2012).

Furthermore, under the U.S. Tax Code, 26 U.S.C. §45Q(d)(2), tax credits are available for those owners or operators who successfully sequester CO_2 from atmospheric release.

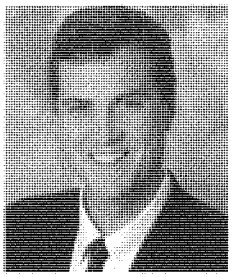
Therefore, facilities that utilize CCS must do so within a regulatory framework that ensures the CO_2 is properly accounted for, and has been isolated from atmospheric release, as well as that sequestration is occurring in a way protective of underground sources of drinking water. Where operators opt to conduct geologic sequestration of CO_2, as a part of or after conclusion of EOR operations, monitoring and reporting occurs pursuant to EPA's Greenhouse Gas Reporting rule under Subpart RR, 40 C.F.R. §98.440 *et seq.* (2012) (Geologic Sequestration of Carbon Dioxide).

The SDWA UIC Class VI and CAA Subpart RR rules, taken together, provide protection of underground sources of drinking water (USDW) and an accounting

[22] *See* EPA, Geologic Sequestration Guidance Documents (available at http://water.epa.gov/type/groundwater/uic/class6/gsguidedoc.cfm)

mechanism for measuring and crediting a source with the amount of CO_2 that is sequestered from atmospheric release.

CLEAN AIR TASK FORCE



Kurt Waltzer is the Managing Director for the Clean Air Task Force. He is responsible for ensuring that CATF has the capabilities it needs to carry out its vision and mission, and that these capabilities are deployed with consistent excellence. In this role, he oversees and supports organizational management and administrative activities, as well as the ongoing development and implementation of CATF's strategy and development of new efforts.

In addition to management responsibilities Kurt also spends a dedicated portion of his efforts focused on the goals and strategies of CATF' Fossil Transition Program. He bas been a long-time advocate for advanced fossil and CCUS in the environmental NGO community and has been working to promote it over the last 12 years within the US and globally. Kurt has led the development of incentive policies for CCUS that have been included in federal legislative proposals. He's also helped develop a powerful informal network of companies and experts on advanced fossil and CCUS, and helped facilitate private sector collaborations in this space.

Kurt has authored and co-authored several reports and articles and managed economic analyses on climate technology and air pollution. He's presented at and participated in several CCS/CCUS technical and policy working groups, and testified before legislative committees and regulatory agencies.

Prior to CATF, Kurt worked for the Pew Center on Global Climate Change in the area of state-based clean energy business development policy, coordinated a campaign of Midwestern ENGOs focused on the reduction of coal power plant pollution for the Izaak Walton League of America, and led the clean energy program for the Ohio Environmental Council from 1997 to 2002. He has served on the Keystone Energy Board and the Technical Advisory Committee for the Ohio Coal Development Office. He has a Masters in Business Administration from the University of Michigan and holds B.S. degrees in both Economics and Biology from the Ohio State University.

Chairman STEWART. Thank you, Mr. Waltzer.

Our final witness then is Mr. Roger Martella, Partner of Sidley Austin Environmental Practice Group. He rejoined Sidley Austin LLP after serving as General Counsel of the United States Environmental Protection Agency, concluding ten years of litigation and handling complex environmental and natural resource matters at the Department of Justice and EPA. Mr. Martella served as EPA's Chief Legal Advisor, supervising an office of 350 attorneys and staff in Washington and 10 regional offices. Mr. Martella, welcome.

TESTIMONY OF MR. ROGER MARTELLA, JR., PARTNER, ENVIRONMENTAL PRACTICE GROUP, SIDLEY AUSTIN

Mr. MARTELLA. Thank you, Chairman Stewart, Chairman Lummis, Ranking Member Bonamici and Ranking Member Swalwell for the opportunity. I am honored to be before you today with my distinguished witnesses, speakers as well.

I am going to try to very briefly discuss the intersection of how these technical issues connect with the legal framework and try not to give you an entire legal dissertation on this but just hit the high points, and I will be happy to answer any questions you have.

Very briefly, the whole reason we are here arises out of a 2007 decision called Massachusetts versus the EPA by the Supreme Court, and in that decision, the Supreme Court said that EPA had to consider greenhouse gases alongside the other air pollutants in the Clean Air Act. I was general counsel at the time when the decision came down and was tasked with working with the EPA lawyers, most of whom are still there, and other talented lawyers in the Federal Government on coming up with a full range of legal options on how to implement the mandate in the Supreme Court's decision, and one of the things we looked at very closely, which was in a 2008 document released by EPA at the time, is the New Source Performance Standard program. If you look at, you know, the limited tools EPA has under the existing Clean Air Act to address greenhouse gases for stationary sources, the New Source Performance Standard program clearly stands out. It is the most flexible of the provisions. It has a history of driving environmental results. It considers cost-benefit considerations, and of course as we have talked about today, I think as everyone is familiar with, Congress directed EPA to focus on standards that were adequately demonstrated.

So it is pretty obvious if you look at the 2008 document and work that has been done since that the highlight, the focus of attention on addressing greenhouse gases under the Clean Air Act has been on the New Source Performance Standard program when it comes to stationary sources, and so my critique is not with that as a general proposition, my critique is how EPA specifically proposed to go about this in September based on some of the technical concerns you are hearing today, and I am just going to again focus on the two words that matter the most for today's discussion, the words "adequately demonstrated."

There is a maxim the law that when Congress uses specific words, it has to mean something, that you have to actually pay attention to the specific words that Congress provides in the statute,

and I recognize that that is never necessarily a black-and-white thing, that everything is a continuum and even something such as "adequately demonstrated" does not lock anyone into any one interpretation but a continuum of interpretations unless you otherwise say that we shall do something or have to do something. So the question here is, where on the continuum does EPA's approach fall, and it is my position, it is my opinion that given the technical expertise of the folks here and other people that I have spoken to, that this does fall past the end points of what is considered adequately demonstrated, the notion of requiring a technology is adequately demonstrated that is not currently in operation by EPA's own record where EPA has said there is not a single facility in commercial operation today. About 18 months ago in April 2012 in the predecessor proposal they said that this technology was not likely to be adequately demonstrated for another ten years, that even if we look back on the last 30 months of EPA's experience in granting permits for greenhouse gas emissions across the country, that it has actually rebuffed arguments by certain groups that CCS is currently adequately demonstrated. It came as a surprise to me, and I think it is past the continuum for them to say back in September that currently carbon capture and sequestration is within the realm of options they can consider in saying something is adequately demonstrated.

Now, having said that, there has been some conversation already today about what is the precedent of this and what is the effect of this, does this really affect anyone, and I think the concern as a whole is from the precedential perspective for a few reasons. First of all, the result of this rule, if this rule is finalized as it exists, and I think it is fair to say that no coal-fired power plant could be built in the United States unless they could really demonstrated carbon capture and sequestration of the magnitude EPA requires, and the experts to my side here, some of them seem to think that is not possible. So the precedent of that is basically that this rule would have the effect of preventing an entire source of energy from being used in new facilities in the future, and so I think one of the questions that comes up is, is that within the legal authority of the Clean Air Act? Can the Environmental Protection Agency—did the Congress intend for EPA to have that kind of authority to say we are going to basically phase out this type of energy going into the future. And while I recognize there is not an apples-to-apples comparison in terms of how this rule could impact existing sources or even sources in other sectors, I think it also has to be understood that there is no doubt that everyone is going to be looking to this rule as the baseline for how EPA will approach existing sources and how they might approach other sectors. I don't think they are going to start with a clean drawing board but they are going to be looking to other approaches here, even if it is not carbon capture and sequestration. So I think there is little debate that this will have precedent on how they are going to approach other issues, others types of facilities.

So thank you for that, and I look forward to answering any questions you might have.

[The prepared statement of Mr. Martella follows:]

EPA's New Source Performance Standard for Electric Generating Utilities:
Dissecting the Legal Rationale for a Policy Driving Rule

Roger R. Martella, Jr.
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Chairman Stewart, Chairman Lummis, and Ranking Members Swalwell and Bonamici, thank you for providing me the opportunity and the honor to appear before you today.

The subject of today's hearing is critically important because it addresses both the technical and legal basis for what I believe is the most important and impactful regulation of the Obama Administration's Environmental Protection Agency: The New Source Performance Standard for Greenhouse Gases from Electric Generating Units (hereinafter, the EGU NSPS). I commend the Subcommittee for addressing this issue at a key time, and look forward to assisting your ongoing efforts.

We should be exceedingly proud that in the more than 40 years since Congress enacted the Clean Air Act, the United States simultaneously has promoted the healthiest skies and the strongest economy in the world. Congress in the Clean Air Act provided EPA specific mechanisms and tools to achieve the policy and science based goals the Agency deems necessary to fulfill its environmental mandate, but within the context of a specific and strict legal framework that the law's provisions delicately articulate. As EPA proceeds to address climate change using a law that was enacted without consideration for the unique and fundamentally distinct circumstances of greenhouse gas (GHG) emissions, these existing legal authorities are being put to new tests. While, as a general proposition, I do not take issue with EPA's authority under the New Source Performance Standard program to address GHG emissions under appropriate circumstances, the Agency's chosen path in the proposed EGU NSPS, by EPA's own admissions, surpasses the bounds of its legal authority into the realm of arbitrariness and capriciousness. Congress, in enacting the Clean Air Act, and Section 111 in particular, strictly limited the Agency's authority to control air emissions from stacks and did not authorize EPA to do what it proposes to do here and phase out an entire source of energy in the United States.

By way of background, I am both a lifelong environmentalist and a career environmental lawyer. I am very proud to have spent the majority of my career in public service, as a trial attorney in the Justice Department's Environment Division, as the General Counsel of the United States Environmental Protection Agency, and

as a judicial law clerk on the Tenth Circuit Court of Appeals. In my current capacity as a private practitioner, I am privileged to work with a plethora of stakeholders including private companies and trade associations, environmental organizations, and the government, to develop creative solutions that advance environmental protection while also enabling the United States to retain economic competitiveness in a trade sensitive, global environment where very few economies provide even the faintest glimmer of our own environmental controls and public process protections.

In both my government and private careers, I am very proud of the opportunities I have had to participate in and advance environmental rule of law initiatives, working to help develop the enactment of environmental and public participation laws in growing economies. In particular, I am proud to serve as the co-chair of the International Bar Association's Climate Change Justice and Human Rights Task Force and vice-chair of the American Bar Association's Sustainable Development Task Force. Last year I was honored to have served as one of five American Bar Association delegates to the United Nations at the Rio+20 sustainable development conference in Brazil, and this year was one of five ABA delegates to the World Justice Forum on environmental and climate change justice issues.

During my tenure as EPA General Counsel, the Supreme Court decided the landmark case *Massachusetts v. EPA*. In brief, the 5-4 decision compelled EPA to consider the regulation of greenhouse gases alongside other "air pollutants" under the Clean Air Act. Shortly after the decision, President Bush and the White House tasked me to oversee the development of legal options and authority for promulgating the first-ever national GHG controls in the United States under the Clean Air Act. Working with the talented group of lawyers in EPA's Office of General Counsel and other federal agencies, I formulated a full range of legal options, along with associated pro and con considerations.

As part of this assessment, I came to appreciate certain advantages of utilizing Section 111 of the Clean Air Act ~~the~~ New Source Performance Standards provision over the various options available to address GHGs from stationary sources. When applied appropriately, NSPS can be the most effective tool for driving environmental results and emission reductions while considering the costs and benefits on those subject to such controls, the economy, energy security, and, ultimately, consumers. In fact, I advised that if EPA were compelled to regulate GHGs from utilities, NSPS should be the preferred mechanism to pursue among the existing Clean Air Act options given its flexibility, its history of realizing

environmental results, and the statutory mandate to consider demonstrated technology and weigh costs and benefits of the promulgated standards.

Thus, given my history, experience, and perspective regarding Section 111, it is with regret that I offer my opinion that the NSPS EGU proposal EPA released in September steps beyond the legal bounds of the authority Congress established in the Clean Air Act.

As other witnesses have testified today, the approach EPA proposed in the EGU NSPS raises numerous technical and policy concerns for coal and pet coke fired EGUs. In setting a performance standard of 1,100 pounds of CO2/MWh, the proposed NSPS relies on two technical assumptions: (1) that the single best-performing Integrated Gasification Combined Cycle (IGCC) facility in the nation is the representative baseline for the coal and pet coke EGU industry as a whole; and (2) that carbon capture and storage is "adequately demonstrated" technology today. Relying upon these technical assumptions, EPA's proposed NSPS establishes the 1,100 pounds CO2/MWh performance standard, a standard which no commercial coal or pet coke facility in the United States if not anywhere in the world can come close to meeting. Thus, as a policy ramification, the proposed NSPS has the practical effect of being as much an energy regulation as an environmental regulation given its impact of phasing out any new coal or pet coke facilities from being built in the United States.

I defer to today's witnesses to address the technical and policy ramifications of this proposal, and instead focus on several key legal deficiencies based strictly on the record upon which EPA relies in the Rule. (The EGU NSPS raises numerous legal questions beyond the scope of this testimony, but given the focus of today's hearing I am focusing specifically on the legal ramifications of the technology questions that are at issue today.)

Let's start with the language in the Clean Air Act itself. The opening provision of Section 111 defines a "standard of performance" as

> a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been **adequately demonstrated**. (emphasis added)

Although the intersection of this text with EPA's proposal raises scores of legal questions and issues, for today's purposes my focus entirely is on two simple words: "adequately demonstrated." Although lawyers frequently deserve a reputation of making simple things more complicated than they need to be, I will resist that temptation today. "Adequately demonstrated" simply means what it says, and there is no need to go further to understand the fundamental and fatal flaw in EPA's proposal.

First, to base an emissions standard for all coal facilities on IGCC technology runs counter to a long standing EPA precedent that EPA cannot require facilities to "redefine the source." In other words, EPA itself long and consistently has recognized that it is not the Agency's role to dictate or switch the type of facility and energy source any given project is to utilize, but instead to identify the best system of emissions reductions for the type of source that is proposed by the project developer. IGCC units, which use combustion turbines, have significantly different designs than coal-fired boilers. Thus, EPA departed at the outset from established past precedent in utilizing a baseline that mandates the type of source facilties are required to build.

Second, and the primary focus of today's hearing, EPA clearly erred in requiring CCS under Section 111 given that, by the Agency's own admissions, the technology is not "adequately demonstrated." To be clear, EPA itself in the proposal concedes that no coal fired boiler has ever been in commercial operation with CCS or achieved the proposed limit. Simply stated, EPA in the record does not point to a single operating facility in the United States ~~or~~ in the world ~~that~~ is currently utilizing the technology that it says is "adequately demonstrated." It similarly fails to point to any commercial source that even comes close to meeting the standard that it requires as "adequately demonstrated." Importantly, EPA's prior proposed rule from April 2012 did not project CCS to be adequately demonstrated for another 10 years. This proposed rule claims that CCS is currently demonstrated, but provides no explanation of why EPA changed its outlook so dramatically in less than 18 months. Finally, beyond the record of this specific rulemaking, EPA's proposed standard also is entirely inconsistent with the Agency's last 30 months of issuing GHG permits for new facilities under the Prevention of Significant Deterioration program.

To address these legal inconsistencies, EPA provides an extensive legal justification for utilizing NSPS to develop "evolutionary" new technologies. I do not dispute that one element of many environmental standards is a technology-driving consideration, even if such technology comes with a significant cost for the

regulated community, and that such standards legitimately can serve dual purposes simultaneously of driving emissions reductions while promoting the development of important new technologies. However, even when EPA is allowed to promote technology driving standards to some extent, Section 111 does not delegate carte blanche authority to simply mandate new technologies that do not satisfy the statutory mandate of "adequately demonstrated." Those two words are explicit, intentional and cannot be disregarded. It is not necessary to look any further than EPA's record in the proposed NSPS to conclude that the technologies EPA would require are not "adequately demonstrated" today, and thus violate the letter and the law of Section 111. A lengthy and complex legal justification in and of itself cannot compensate for a disregard of the plain language of the text of the statute, and EPA's legal advocacy cannot fix a conclusion that is arbitrary and capricious under the Act.

Finally, beyond the legal ramifications of this proposal on new EGUs, it is critical to anticipate and appreciate the potential precedent of this Rule on other types of facilities. First, once EPA finalizes this rule, certain groups are likely to argue that this standard "sets the floor" for so-called Best Available Control Technology (BACT) standards for facilities that are required to obtain a pre-construction permit under the Prevention of Significant Deterioration (PSD) program. Thus, this standard has the potential to cascade to other sources not directly regulated by the NSPS and where IGCC and CCS bear even less relevance.

Second, EPA has committed to regulating GHG emissions from existing EGUs no later than June, 2016. If EPA were to apply a similar legal interpretation to existing facilities of requiring retrofits of technology that is not adequately demonstrated, existing EGUs may be required to fuel switch given that Administrator Gina McCarthy has recognized that CCS is not an available retrofit technology for existing sources. Such decisions will be unpractical and uneconomic for many existing facilities, leading to shut downs, reliability concerns, and cost increases. Notably, there is a very strong legal argument that EPA has authority to avoid the regulation of existing sources under the NSPS program in the first instance and thus avoid triggering the ramifications of imposing an energy efficiency standard on the nation's existing utility fleet. This argument that EPA is precluded under Section 111(d) from regulating existing sources that are subject to Section 112's controls for Hazardous Air Pollutants is the straightforward reading of the text of the Clean Air Act and would enable EPA to address GHG emissions from new sources while regulating other emissions from existing sources pursuant to established programs such as the PSD permitting system and National Emissions Standards for Hazardous Air Pollutants.

Third, it is critically important to consider the impact of the EGU NSPS on other NSPS source categories. EPA has signaled ~~if~~ not committed ~~that~~ it plans to regulate the GHG emissions of other source categories through NSPS. However, such other source categories ~~which~~ largely represent the nation's manufacturing sectors— are fundamentally distinct from EGUs. First, EPA must make separate and distinct ~~'endangerment'~~ determinations for each source category and decide, under Section 111, whether the emissions from a specific source category pose a "significant" contribution to endangerment. Second, unlike utilities, the processes employed by most manufacturing source categories are unique and distinct for each facility, prohibiting across the board regulation of energy use or efficiency. Third, most other source categories are trade exposed, meaning that the impact of GHG regulations on a particular source category could merely lead to such industry being located to other areas of the world that are less energy efficiency, resulting in net increases in GHG emissions globally. For these reasons, EPA should clarify that nothing it does regarding utilities shall serve as precedent for other source categories that are fundamentally distinct.

Thank you for the opportunity to share my views on this important topic. I would be happy to answer any questions.

ROGER MARTELLA is a partner in the Environmental Practice Group at Sidley Austin LLP. He rejoined Sidley Austin LLP after serving as the General Counsel of the United States Environmental Protection Agency, concluding 10 years of litigating and handling complex environmental and natural resource matters at the Department of Justice and EPA.

Mr. Martella's practice focuses on three primary areas. First, Mr. Martella advises companies on developing strategic approaches to achieve their goals in light of rapidly developing demands to address climate change, promote sustainability, and utilize clean energy. Second, Mr. Martella handles a broad range of environmental and natural resource litigation and mediation. Third, Mr. Martella advises multinational companies on compliance with environmental laws in the United States, China, the European Union, and other nations.

Mr. Martella counsels approximately 40 of the world's leading conventional and renewable energy, industrial, transportation, agricultural, forestry, and technology companies on bet-the-company environmental issues, regulatory matters, and litigation including transitioning to an era of legal controls addressing greenhouse gas emissions, increasingly stringent pollutant controls, alternative and clean energy, hydraulic fracturing, and sustainability both in the United States and abroad.

The 2013 edition of The International Who's Who of Business Lawyers lists Mr. Martella as one of the ten leading environmental lawyers in the world. The 2013 edition of Chambers includes Mr. Martella among its top-tier Washington, DC's environmental and national Climate Change lawyers and Chambers Global recognizes Mr. Martella as one of the top Climate Change lawyers globally.

Mr. Martella graduated from Vanderbilt Law School, where he was Editor in Chief of the Vanderbilt Law Review, and Cornell University, where he studied environmental science. Following law school, he clerked for the Hon. David M. Ebel of the Tenth Circuit Court of Appeals.

Chairman STEWART. Thank you, Mr. Martella.

To all of the witnesses, thank you for your testimony. I would like to remind Members that Committee rules limit the questioning to five minutes, and the chair at this point will open up the round of questions, and the chair recognizes himself for five minutes.

Mr. Martella and Mr. McConnell, I would like to come back to some comments that both of you have made. Mr. Martella, you said something I think a little more graciously than I would have in the sense of the meaning of words. I think that this all started a few years ago perhaps when we heard that famous phrase, "It depends on what the meaning of the word is is." Redefining words away from their original and their obvious intent opens up just a Pandora's Box of craziness. Who knows where it will end, and who knows what the outcome eventually is going to be, which is the main point of this hearing. This isn't about climate change. This hearing isn't about the government shutdown and effects of that. It is not even about the costs of implementing this rule. This is about—and by the way, I have enormous concerns with the costs of implementing this rule, but we are not there yet. This is about one thing and one thing only: is the EPA being honest in their claim that a certain procedure has been adequately demonstrated. And in that, it is not adequately modeled, it is not adequately hypothesized, it is not adequately wished for. Is it adequately demonstrated? And demonstrated in the real world and demonstrated in a way that could be replicated somewhere else and in fact replicated in a lot of different places because it is going to have to be in order for it to be implemented like that.

So with that, Mr. Secretary, I would like to come to you for just a minute. Let me ask first just some background. When did you leave your position at DOE?

Hon. MCCONNELL. February this past year.

Chairman STEWART. And how long did you work for the current Administration?

Hon. MCCONNELL. Two years.

Chairman STEWART. Okay. And I am sure that was a great experience for you, working for the Administration, and being here today, I suppose, you and I had a chance to have a short conversation before the hearing, and I recognize it may be somewhat uncomfortable for you in the fact that you have taken a position that is contrary to the current Administration.

Hon. MCCONNELL. Oh, I don't find it difficult at all. It is a truth that we are pursuing here, and the commercial viability and technical demonstration is all about what we were doing and continue to do with a pretty sizable Federal funding of the R&D that is going on. Now, it seems to me to be a little difficult to balance the fact that if something is already technically demonstrated and commercial available, why we would continue to fund R&D in that regard, it is a bit of a conundrum and it is puzzling to me.

Chairman STEWART. Well, I appreciate that. That is a great point.

To any of the witnesses, are any of you aware of any commercial-scale power plant in the United States that is using CCS right now, anywhere in the United States?

Mr. WALTZER. Mr. Chairman, Plant Berry at First Southern Company supplies CCS on their units, a 25-megawatt project, and they are capturing about 100, 150,000 tons per year.

Chairman STEWART. Okay, and 25-megawatt, is that a small- or a large-scale power plant?

Mr. WALTZER. It is a slipstream project from the power plant.

Chairman STEWART. So it is a very small production of power that is generated from there relatively speaking?

Mr. WALTZER. From that unit, yes.

Chairman STEWART. And that is really one of the primary concerns we have, and that is, the demonstrated scalability. You know, I was a pilot for a long time. I was the type of pilot at one point where we few test flights, and I am telling you, you can't take something and say it works here on this scale and then increase that scale by many factors and just assume that it is going to work exactly the same way; it won't, which is again one of our primary concerns here.

Dr. Bajura, you mentioned that as well, the scaling up of technology. I would be interested in your thoughts on that and your concerns about trying to apply something that is as unique and complicated as it is and just assume—and if I could, and then I will allow you to answer this. Quoting from the EPA's own findings from just several year ago, a typical power plant, "there is considerable uncertainty,"that is their word, "considerable uncertainty associated with capacities at volumes necessary." Doctor, do you have comments on that?

Dr. BAJURA. Yes. We often test technologies from test tube size in a laboratory to pilot plant sized to commercial size. The comment you made earlier about the size of plants, we have put in place 12 plants in the last six years. The average size is one gigawatt. That is 1,000 megawatts. We don't do that casually. We do it by building up, and the reason we do that is, we learn things as we go from one size to another, the integration being the very important part.

Chairman STEWART. Thank you. And again, I think the point there is stated in one fashion or another by the EPA themselves, that there is enormous concerns with the scalability on this, and with that, my time is expired.

We now turn to the Ranking Member, Ms. Bonamici.

Ms. BONAMICI. Thank you very much, Mr. Chairman, and thank you all for your testimony.

Mr. Waltzer, I wanted to talk a little bit with you about the different standards that we have been hearing about today. We have heard commercially available, technically ready, but the EPA really does look at whether the technology is adequately demonstrated, which of course is different in legal terms. Do you agree with that?

Mr. WALTZER. Absolutely. The Clean Air Act very clearly allows EPA to consider how the technology applies and other related industries, and I think in some areas there is a bit of a gray area relating to your earlier question, Mr. Chairman. So for example, Dakota Gasification is an excellent example of a project which is a very large scale, captures 2 million tons of CO_2 per year and sends it up a pipeline to Saskatchewan for EOR and sequestration. The methane that comes out of that coal gasification project is de-

livered in the pipeline to power plants. It is very similar to a power plant that was proposed by Tanaska, which would have simply taken that same industrial configuration and put the power plant closer to that methane, the coal-to-methane project. So from a practical perspective, it is not—the Dakota Gasification plant, I believe, clearly demonstrates that one could develop a power plant today with commercial guarantees with CCS. In fact, even though Kemper does have commercial guarantees, I think the Dakota Gasification plant clearly demonstrates that CCS at a power plant configuration is in operation today.

Ms. BONAMICI. Thank you. I am going to follow up on that a bit. If finalized, the rule would require that all new coal plants meet an emission rate between 1,050 and 1,100 points of CO_2 per megawatt-hour. So that is an approximate 40 percent reduction below uncontrolled emission levels, as I understand it.

Mr. WALTZER. That is right.

Ms. BONAMICI. But in addition, the rule allows for up to eight years to meet the standard. Can you discuss how that provision was considered in EPA's determination of feasibility and cost?

Mr. WALTZER. Sure. That provision is, from our perspective, one of the key aspects that makes this rule— the design of this rule very smart and speaks to the technical feasibility of being able to comply with the rule. With that eight-year provision, that allows a project developer to do two things. First, it allows them to have flexibility as their building their first, second, third or nth-of-a-kind project. It also allows the developer market flexibility to be able to take advantage of operating the plant in the early years without CCS and adding CCS later, which might provide financial value. In fact, it is that second component which allows, as our cost analysis shows, for a project to be able to comply with that standard and have the cost of electricity at that coal unit be 13 percent above the baseline cost of electricity for an uncontrolled coal unit.

Ms. BONAMICI. Thank you. I have another question I want to get in. So there was a project that American Electric Power was doing. Their chairman in 2011, Michael Morris, said that "As a regulated utility, it is impossible to gain regulatory approval to recover our share of the cost for validating and deploying the technology without Federal requirements to reduce greenhouse gas emissions already in place. The uncertainty also makes it difficult to attract partners to help fund industry share." So I wanted you to address briefly the—unless we require carbon emission limits on new coal power plants, does the technology stand as much of a chance of wider deployment, and why?

Mr. WALTZER. Well, I do agree with that, but let me address one important aspect of what you just raised. I would urge the Committee to consider that in fact this rule is good for the coal industry, and let me explain that counterintuitive view. First, the rule provides both certainty and flexibility for new coal plants regarding CO_2 emissions. If you don't have that certainty, you are not going to be able to finance new coal plants. No financing, no plants. It is basically that simple. Second, the rule does something that might have been hard to imagine 30 years ago. For the first time, new coal plants and new gas plants are going to have the same emissions profile. That is important for coal's long-term sustain-

ability. And third, gas prices are so low that no one is building new coal, and that is true without CCS, but this rule helps catalyze technology advancements so that when fuel prices are more advantageous, coal is even better positioned within the market.

Ms. BONAMICI. Thank you, and I see my time is expired. Thank you, Mr. Chairman.

Chairman STEWART. Yes, Ms. Bonamici. And Mr. Waltzer, you almost by yourself require that we come back to a second round of questioning because I can't wait to engage you with your comments there about this is good for the coal industry.

With that, then we turn to the chairwoman of the Subcommittee on Energy, Ms. Lummis.

Chairwoman LUMMIS. Thank you, Mr. Chairman.

Secretary McConnell, does it make any sense to you that EPA is concluding that CCS is adequately demonstrated or proven when the DOE modeling assumes carbon capture technology is unproven at commercial scales?

Hon. MCCONNELL. No, it doesn't make any sense to me, and in fact, in 2010, a roadmap was put forth that with demonstration projects and the development of the fossil program would produce a commercially ready, technically deployable CCS value proposition for the marketplace by 2020, and the expectations were that the demonstration projects, the knowledge, the understanding and the learnings that would be accomplished through all of that would produce something that would be marketplace-ready by 2020. And declaring it ready now, I don't see as something that makes any sense to me, no.

Chairwoman LUMMIS. Mr. Waltzer, you mentioned this eight year period. Is that what Mr. McConnell is referencing? Should I be drawing a connection between the eight years that you mentioned and Mr. McConnell's statement about the year 2020 applicability?

Mr. WALTZER. Madam Chairman, from our perspective, just a quick reference. The original proposal actually had a ten-year delay. That was in the revision that was made eight years because that comports with the eight-year review period that relates to New Source Performance Standards. So I think that is really what is the—what is driving the eight-year review or flexibility provision within this rule.

Chairwoman LUMMIS. Okay. So they are very different. I am trying to compare apples to oranges here.

Mr. WALTZER. Right.

Chairwoman LUMMIS. That is helpful. So if the technology is ready today, why the eight years again?

Mr. WALTZER. From our perspective, we think it is valuable because we want to see projects built, and we think that kind of flexibility encourages projects. It reduces their costs. It provides them flexibility as they are developing pioneer projects. We like to say we want to avoid pioneer penalties. We want early-adopter rewards, and this, I think, is in vein with that concept.

Chairwoman LUMMIS. Okay. So it is a pioneer situation?

Mr. WALTZER. For any project that—well, there are multiple pioneer situations. For example——

Chairwoman LUMMIS. But how does the word, your use of the word "pioneer" comport with the EPA's definition of "adequately demonstrated"?

Mr. WALTZER. Well, "adequately demonstrated" as I mentioned before can be related to—or can refer to related industries. So, for example, I would consider—even though we have a fully commercial-scale gasification project at Dakota Gasification that is taking CO_2 and sending it up to Alberta—excuse me, Saskatchewan. Locadia proposed a substitute natural gas program in Indiana, which is very similar. And we were supportive of that project because even though it wasn't a power project, it would have created a pipeline from the Midwest to the Gulf Coast. I would consider them a pioneer even though that technology is commercial.

Chairwoman LUMMIS. I think you said CCS is being used today on natural gas units?

Mr. WALTZER. CCS—well, CCS has been used on natural gas units for power plants.

Chairwoman LUMMIS. Okay. So why not require this rule be applied to gas? Why is it just applied to coal?

Mr. WALTZER. We are actively supporting CCS on natural gas projects. So, for example, Summit Power has a——

Chairwoman LUMMIS. So why did the EPA just require it for coal?

Mr. WALTZER. Well, from our perspective, and I will speak from our perspective, we see—we don't see this rule as the last step; we see it as the first step. So——

Chairwoman LUMMIS. Oh, okay. That is helpful.

Mr. WALTZER. For the eight year review, we would——

Chairwoman LUMMIS. Dr. Bajura—excuse me because I have one more question. Dr. Bajura, the Interagency Task Force on CCS identified five barriers to commercial deployment of CCS. What has changed in the two years since their conclusion?

Dr. BAJURA. We have done some experiments to demonstrate storage at larger scale but we haven't done any integration to show how we could put that together with a power plant nor have we addressed the issue of long-term liability: who owns the CO_2 for 50 years, who is going to take the responsibility for certifying that the technology was correct when it was put in the ground.

Chairwoman LUMMIS. I want to thank all of our panelists. I hate to interrupt but my time is expired. Thank you all for being here.

I yield back, Mr. Chairman.

Chairman STEWART. Thank you, Madam Chairwoman.

The chair now recognizes Mr. Swalwell.

Mr. SWALWELL. Thank you, Mr. Chairman, and actually, if we could put slide number one back up there, and Mr. Waltzer, good morning, thank you to you and all of our witnesses for being here. Slide one, I held it up earlier, and it will be on the screen in a moment, depicts about 600 coal plants across the country. Are you familiar with this map and these plants, and would you agree, Mr. Waltzer, that the proposed regulations that the EPA have put out will not affect a single plant that is on that map?

Mr. WALTZER. Absolutely. Even before this rule was contemplated and even before gas prices went through the floor, there was no new coal plant that was proposed without CCS. Any new

coal plant today that has been seriously proposed will meet the new coal plant standard. For existing units, this rule doesn't apply so it is not going to have any effect on them.

Mr. SWALWELL. And Mr. Waltzer, how many jobs at existing coal plants will be lost because of these regulations for future plants?

Mr. WALTZER. There will be no—I think it is simple logic that if the rule does not apply to existing units, it will not affect jobs at existing jobs, so no jobs.

Mr. SWALWELL. And Mr. McConnell, would you agree that these regulations will not affect a single job at a currently existing plant?

Hon. MCCONNELL. No, I wouldn't.

Mr. SWALWELL. Okay. Would you agree—so it is your position that if I have a job today at a coal plant that is already in existence, I am at risk of losing my job at that plant because of rules for plants that have not been built?

Hon. MCCONNELL. I think if we focus the argument strictly on one particular pollutant criteria, we could build an argument around it but it is much more complex than that. It is the future uncertainty of rulings. It is the combination of NOX, SOX, sun particulates, mercury, all of the criteria pollutants and the landscape associated with that uncertainty going forward. You see a tremendous amount of retirements going on across the country today, some 50 gigawatts of retirement.

Mr. SWALWELL. But Mr. McConnell, the 600 plants that are in existence, you agree, these rules do not directly affect those plants?

Hon. MCCONNELL. No, I don't. Again, as I go back to the interconnection of all the rulings and the future uncertainty of it, that has a multiplying effect to the future of all of those coal plants.

Mr. SWALWELL. But you can't give me an accurate number as to how many jobs are going to be lost at a current plant because of regulations for future plants, can you?

Hon. MCCONNELL. No, I am not able to provide that kind of information, no, sir. Again, it is all part of the future that you or I can't predict.

Mr. SWALWELL. And you would agree, though, that 120,000 jobs lost in 16 days during a government shutdown, that is probably greater than the amount of jobs we can say will be lost at existing plants?

Hon. MCCONNELL. I am not in a position to comment on that.

Mr. SWALWELL. I would hope, though, Mr. McConnell, that you could comment on something I think you and I may agree upon, which is that sequestration has affected our ability to make necessary investments in technology when it comes to carbon capture, use and storage technologies. Would you agree that that is not helping us learn more about what that technology could do?

Hon. MCCONNELL. What I could agree on was that when I took the job in 2010, and we projected for the next ten years that we would stay at a certain level of funding for fossil energy, to move forward and to achieve a commercially demonstrated technology by 2020, and then seeing the fossil budget cut year over year with the Administrator's requests going down while the overall Department of Energy goes up, that made it very difficult to achieve those targets, and makes it all the more difficult to understand how we can

get demonstrated technology in place any earlier than 2020 certainly.

Mr. SWALWELL. Thank you, Mr. McConnell.

And Mr. Waltzer, can you just go into detail for us about the current competition between the coal and natural gas industries and whether that competition is at least a partial reason, if not the primary reason, for the retirement and lack of construction of new coal plants across the country? And then can you just let us know what would the cost of doing nothing be? Suppose we threw out these regulations and just did nothing, what would the cost to the environment and economy be?

Mr. WALTZER. So here is what I would say. Project developers today are building natural gas plants instead of coal plants, primarily because of where gas prices are. That is what is happening in the market. In terms of existing units, gas prices had gotten so low that we for the first time ever had seen coal power switch over to natural gas, which many of us thought would ever happen, but that is starting to come back. So as gas prices are going up, we are starting to see coal—existing unit coal generation come back on the system. But because of where gas prices are, we don't foresee, or at least looking at the market, the market tells us there are no plans for developing new coal projects because of where gas prices are today.

Mr. SWALWELL. Thank you, and Mr. Chairman, I yield back the balance of my time.

Chairman STEWART. Thank you, Mr. Swalwell. You know, regarding your question about existing power plants and will they be affected, I think Mr. Waltzer, you answered that question in the previous round, and that is when you said you view this as just the beginning, and I think that is many of the fears that so many of us have.

With that, to the Vice Chairman, Mr. Bridenstine.

Mr. BRIDENSTINE. Well, thank you, Mr. Chairman. I can tell you there are two coal-fired power plants in Oklahoma that are being shuttered because of EPA regulations, and I can also tell you that my constituents are facing 25 percent increases in their prices because of it, and these coal-fired power plants have, like, 30 years left in their useful lives and we are shuttering them because of these regulations.

I would like to talk to Mr. Waltzer. You mentioned early-adopter rewards. Can you talk about that for just one second?

Mr. WALTZER. Sure. We would like to see—from our perspective, we want to see CCS move forward and we would like to see a suite of policies that help both deploy the technology and drop its costs rapidly.

Mr. BRIDENSTINE. Is the Kemper project one of those projects where you have seen early-adopter rewards?

Mr. WALTZER. Well, in some respects, Kemper has received incentives, Federal incentives, to move forward. So in that context, it has gotten——

Mr. BRIDENSTINE. I would like to read you an article from the Wall Street Journal, and this is just a few weeks ago, Monday, October 14th, as a matter of fact. Mississippi Power's 186,000 customers who live in one of the poorest regions of the country are

reeling at double-digit rate increases, and even Mississippi Power's parent, Atlanta-based Southern Company, has said Kemper shouldn't be used as a nationwide model. Do you agree with that?

Mr. WALTZER. I believe that the cost overruns associated with Kemper are not related to CCS. It is related to the fact that there are commercializing a new gasification technology, and so from that perspective, I believe Kemper could be a model for integrating CCS onto power systems.

Mr. BRIDENSTINE. It is interesting you should say that. They said that their cost overruns are from labor costs, steel pipe, concrete, other materials, and certainly if it wasn't for CCS, a lot of these materials wouldn't be required. Is that correct? And labor.

Mr. WALTZER. I think most of the labor costs and piping that you are referring to really is based on the fact that they are effectively developing a refinery technology, which is not what power companies are used to doing.

Mr. BRIDENSTINE. So these costs, do you know how they are affecting not just—I mean, we are talking about some of the poorest people in America being affected by this. They spend a good portion of their budgets more as a percentage of their income on their electric bills, and their electric bills are going up. Do you have sympathy or empathy for them?

Mr. WALTZER. I think that it is important to make sure that anytime we are moving technology forward, that we try to have the least amount of impact on the people who can least afford it. I think that is true in the United States and I think that is true globally. That is why we are supporting not just these performance standards but incentives at the Federal level that will help reduce the costs——

Mr. BRIDENSTINE. Real quick, I want to talk about these incentives. I am a Navy pilot and I flew in Meridian, Mississippi. I lived there for a period of time. I can tell you this, Meridian, Mississippi, just south of Kemper County, is not a wealthy part of the country. Mr. Newburn Atkinson, a gentleman, says that his Lucas Road art and jewelry gallery hasn't recovered from the recession. "I am already on a shoestring budget and this economy," the 66-year-old says, "and this may be the deciding factor in me staying open." So here we have people saying that power plants are not being shuttered; in fact, they are. We have people saying that this is actually an early-adopter rewards program, which it isn't. It is punishing people. It is punishing the poor people. It is also punishing the investors, which prevents investment in further technologies like this, and then you talk about incentives. Let us talk about incentives.

We have a chart—do we still have that chart, the Department of Energy chart about incentives for R&D for different areas? Do we have that chart? Well, while we are waiting for the chart to come up, I will share with you what is on this chart. On this chart, you have incentives for natural gas and liquid petroleum on the left. It is almost nothing. It is 64 cents per megawatt-hour. Nuclear is $3.14 per megawatt-hour. Wind, $56 per megawatt-hour. And then solar on the far right, if the chart were big enough, it would go through the roof. For wind, it's $775 per megawatt-hour, or 64 cents for gas. Now, do you think it would be a good idea to maybe

shift some of those incentives from wind and solar maybe over to the gas and fossil fuel side?

Mr. WALTZER. We think we should have more incentives on the fossil fuel side, absolutely.

Mr. BRIDENSTINE. But you don't think it should be taken from—you know, it is 1,400 times more on solar energy. Do you think that that might be a good place to start?

Mr. WALTZER. We are not—here is what I can say what we support. We support, as I mentioned before, the National EOR Initiative, which is focusing on a production tax credit for CO_2-enhanced oil recovery from coal plants, gas plants, industrial sources, and what is really unique and interesting about that proposal is that because you are generating petroleum through EOR in the United States, you are also displacing foreign-oil production. That potentially could add new revenue to the U.S. Treasury, and so that is a really unique and interesting opportunity, and we think we should pursue that.

Mr. BRIDENSTINE. I am out of time, Chairman. It is your mic.

Chairman BRIDENSTINE. Thank you. I am going to return time now to Mr. Takano.

Mr. TAKANO. Thank you, Mr. Chairman.

Improving air quality and reducing greenhouse emissions is a matter that is vitally important to my constituents in Riverside County, which is located in southern California. I represent an area that has some of the worst air quality in the Nation. I remember days growing up when we weren't allowed to play outside on the playgrounds during my elementary and high school days for physical education class because the air pollution was so bad. It is because of the Clean Air Act and the work by the EPA that my region has seen a tremendous improvement in air quality. In fact, a study by the EPA shows that by 2020, the benefits of the Clean Air Act will outweigh the costs by more than 30 to one. The Clean Air Act has helped improve public health, and by 2020 it is expected to prevent 17 million lost workdays.

I appreciate hearing from our witnesses today about EPA's latest effort to limit greenhouse gas emissions under the Clean Air Act. My first question is for Mr. Waltzer. Mr. Waltzer, do you know of any other nations that are investing in CCS technology?

Mr. WALTZER. Yes, several. The United Kingdom, for example, has a competition for what they call a contract for differences to build at least two large-scale CCS projects. But probably the most interesting and notable is China. They are investing quite a bit in CCS. In fact, Huaneng Power, their largest power company, has developed their own CCS technology that they are currently doing a feasibility study with Duke Energy on one of the Gibson units in Indiana to examine how those costs of CCS in China, which they claim are fairly low, about $30 a ton, would equate in the United States.

Mr. TAKANO. And can you tell me about the overall budget for R&D for all of these all-of-the-above technologies? I mean, I understood that chart presented by my colleague from Mississippi about the distribution of R&D investment but what has been the size of that budget over the last 3 or four years and has it been increasing or decreasing?

Mr. WALTZER. Well, the overall size of the DOE budget has been increasing but I would echo what Secretary McConnell said with respect to CCS. We believe that the DOE's budget on CCS should be increased.

Mr. TAKANO. Now, you used the word "pioneering" in your answer to my colleague from Wyoming. Would you say that the strategy of the Department or the EPA is really about birthing this technology, that when we say we have an adequately demonstrated technology that really the rule is designed to birth it?

Mr. WALTZER. That has been a role that the Clean Air Act has played through several pollution control technologies, and we feel that this is a role it can play here. Just to clarify some earlier remarks I made, we do see this as the first step. We do think CCS ought to be applied on natural gas units and another opportunity to do that will be in the eight-year review as well as looking at best available control technology through individual permits after the New Source Performance Standards are finalized. So we do see this as the beginning of a process. We don't necessarily anticipate that this is going to apply to existing units through any rules that are going to be put forward but we do hope and expect and we would advocate for in the future that this technology would be applied to natural gas.

Mr. TAKANO. Now, real quickly, the Kemper plant is a coal gasification plant, but the existing coal plants, which will not be affected by this rule, are not attempting to gasify. They just strictly use the coal directly into the production of electricity. Is that correct?

Mr. WALTZER. Right. Most existing units are coal combustion units.

Mr. TAKANO. So when you talked about the increased costs at Kemper, it has to do with this newer attempt, this attempt to try to gasify the coal, but if coal plants in the future were to be straight combustion plants, you are contending that the CCS technology has been demonstrated in other areas and could work in the context of newer coal combustion plants?

Mr. WALTZER. Well, actually, yes. In fact, the Boundary Dam plant is an interesting example because, in fact, it is a retrofit, but it is using the same technology that one would use if one were building a new coal combustion plant. Similarly, NRG in the United States is currently developing a retrofit, a CCS retrofit project, that could also apply to new coal combustion units.

Mr. TAKANO. Thank you, Mr. Chairman. My time is up.

Chairman STEWART. Thank you, Mr. Takano.

Now Mr. Weber from Texas.

Mr. WEBER. Thank you, Mr. Chairman.

I think we are going to affect coal plants because as that technology gets so expensive, more plants won't be built and older plants will retire, employees will lose their jobs, so that is a given. And look, I think it was Mr. Martella that said when Congress uses words, it means something. I think that was you that said that. Is that right, Mr. Martella?

Mr. MARTELLA. Yes.

Mr. WEBER. I appreciate that. It is kind of like, if you like your doctor, you can keep your doctor. If you like your insurance, you can keep your insurance. That is kind of what you are driving at,

I suspect, and I guess that oil sequestration is an okay word, or carbon sequestration is okay, but when you talk about budget sequestration, that is a bad word. So it is interesting that we see a lot of word games going on up here.

Let me ask you, are any of you familiar with the Valero plant in Port Arthur, Texas, in my district that has a carbon sequestration facility? Mr. McConnell, are you aware of that plant? Do you know the cost that was involved? Do any of you all know the cost of that plant? Let me give it to you real quickly. The Valero project cost $431 million, okay? The Department of Energy, through the stimulus, or what I call the spend-from-us, kicked in $284 million. Now, that is 66 percent of the cost of that plant. Does that sound it is capable of being duplicated? Does the government have to spend 66 percent of these facilities and these plants? Does the taxpayer get to be on the hook? Does that sound like it's capable of being duplicated? That is a rhetorical question. I will get back to you.

Ed Holland, the CEO of Southern Energy, the owner of the plant built in Kemper, Mississippi, came and spoke to the House Energy Action Team, which I am a member of, about a month ago, and here is what he—let me tell you something about Southern Energy and the plant they are building. Four billion dollars. It creates 12,000 direct and indirect jobs for construction, 1,000 direct and indirect permanent jobs. The project construction will create $75 million in state and local taxes, $30 million annually in state and local taxes. So this is a project that is extremely important and valuable to the community, and yet because of CCS, which Texas is a pioneer. One of you, I think it was you, Mr. Waltzer, or it might have been Mr. Martella that said there was already EOR underway. In other words, what you really said without knowing it was, industry was already on this. Industry was already on this without the mandate from the EPA because they will get it to work efficiently. They will make it work efficiently.

Now, when Ed Holland from Southern Energy came and spoke to the House Energy Action Team, he said CCS is not capable of being duplicated. The cost overruns were enormous, and he attributed it to CCS. Now, to their credit, the company agreed to pick up all the cost overruns, and you don't see that very often when the government mandates something. That is a rarity. But the cost overruns were attributed to CCS. He told us that in the House Energy Action Team.

Now, with what you know about Valero's costs, 66 percent picked up by the DOE, the taxpayers, and the cost overruns at Kemper, is there anyone on this panel that thinks that is really capable of being duplicated? Mr. McConnell, yes or no?

Hon. MCCONNELL. Well, I believe that is the reality of where we are today because it is not technically demonstrated and commercially available.

Mr. WEBER. Thank you. Dr. Bajura?

Dr. BAJURA. I support Secretary McConnell's comment.

Mr. WEBER. What he said. Mr. Waltzer, what they said?

Mr. WALTZER. Can you clarify?

Mr. WEBER. Do you think those two experiences demonstrate that CCS of that magnitude, on the scale that the EPA is mandating here, is capable of being duplicated?

Mr. WALTZER. I think we have seen CCS on the scale of 7 million tons per year at projects like Valero.

Mr. WEBER. Does the cost or the cost overruns not even come into the EPA's——

Mr. WALTZER. That is a purely commercial project.

Mr. WEBER. That is a purely commercial project, so when it comes, EPA is real big about attainment; we don't want noxious gases and we want most of the country to be in attainment, but they don't use the common sense of determining from a cost basis whether it is going to negatively impact industry and jobs. So would you agree with me then, Mr. Waltzer, that in that instance, EPA might themselves when it comes to common sense be in non-attainment?

Mr. Martella, do you think that is duplicable?

Mr. MARTELLA. I have to put my lawyer's hat back on, and as a lawyer, you can only look at the record and what EPA itself relies upon in making these determinations, and I go back to my original opinion. Looking simply at things that they said in this record in the past 18 months or so, I think it is their own admissions that show none of these facilities are in commercial operation to the——

Mr. WEBER. Was that admission or emission?

Mr. MARTELLA. Admission.

Mr. WEBER. Okay. Well, they are putting out some emissions all right, the EPA is. But I appreciate that opinion, and I am overrun on my time.

Chairman STEWART. Thank you.

We now have Ms. Edwards.

Ms. EDWARDS. Great. Thank you, Mr. Chairman, and to our Ranking Members as well for holding this hearing, and thanks to our witnesses.

I just have a couple of questions I want to try to get to, but I want to point out that contrary to some suggestions that have been made here today, the President's energy strategy in fact has embraced the all-of-the-above approach. He said that on many occasions, even when some of us didn't want him to say all of the above. Indeed, the rulemaking envisions, I think, a 21st century approach to fossil fuel power plants with the goal of reducing CO_2 emissions in new power plants, and I think it is important to point out the word "new." In the Recovery Act, the President committed $1.4 billion to this technology, even in the face of some of us who questioned frankly the technology, but that being as it might, the EPA has come up with a rule. It has a specific responsibility, a particular responsibility to protect our health and environment, and while industry considerations are interesting, that is not the principle responsibility of the EPA. But I happen to think that we can do both, that we can both protect the environment and we can grow jobs and we can grow an energy strategy that really embraces all of those responsibilities.

My question, first question, goes to Mr. McConnell. Something you said kind of caught my attention about the jobs question. Were you referring to a specific empirical study, university study, indus-

try study, that points to the number of jobs that would be lost by applying standards to new power plants versus old?

Hon. MCCONNELL. I can't quote any specific study here, only that I have been exposed to a number of studies from several different sources.

Ms. EDWARDS. If you can get back to us on that and give us the particular studies, because I am a data person and I like to see the data that backs up your conclusions that jobs would be lost by applying the rule to new power plants versus old ones, and I would like to see those numbers.

And then my next question goes to Mr. Waltzer. I notice that in the industry, the oil and gas industry receives subsidies to the tune of about $7.5 billion a year. Exxon Mobil made $7.5 billion in profits in 2012, Occidental, $7.1 billion. The numbers are really huge. It seems to me that if we have an interest in doing what Mr. McConnell points out in his testimony is the need to add $100 million a year into demonstrating these projects and research and development that $100 million could come out of that $7.5 billion in subsidies that the industry receives, and so I wonder, Mr. Waltzer, if you could tell us what the additional needs you see in terms of investment in R&D and whether we have made the kind of investments we need to go into the commercial side with these coal plants and the new regulations? Because if, for example, we needed to find more money, perhaps my colleagues on the other side in this very constrained environment would be willing to remove those oil and gas subsidies so that we could put the money into demonstrating new technologies.

Mr. WALTZER. Thank you. Let me first go back to what we think is the most important objective. We think that CCS needs to be deployed globally and it needs to be affordable. So we need to move the technology forward as quickly as possible. So that brings us back to with respect to the oil industry, enhanced oil recovery as an opportunity in the United States. We could potentially have 100 gigawatts of coal plants, about a third of our coal plants, supplying CO_2 for EOR that would produce domestically produced oil if we met the technical potential for EOR in this country. We believe that a self-financing tax incentive is a very smart and effective way to move that technology forward.

What is interesting about that number, 100 gigawatts, is, if you look with the history of scrubbers and other technologies, that—you can significantly push the cost down the cost curve of that scale. It is also going to bring new technologies into the market. So in terms of research and development, two interesting technologies, just an example. One is called chemical looping, which would dramatically increase the efficiency in coal plants and dramatically reduce the cost of CCS. Another would be advanced natural gas turbines. There is at least one company that has a design that would significantly drop the cost of CCS to the point they think they can compete in the market today. So it is that sort of mix of performance standards and incentives that could pull those new technologies into the market while getting the learning curve moving forward, and that is our vision for how we think we move this technology in the United States and how we think—and the value that that is going to have globally.

Ms. EDWARDS. Thank you, and my time is expired, and so I would really love to see us move to a point where we are making investments through our tax code that are about new technologies and not just supporting an old industry that is making record profits. Thank you.

Chairman STEWART. Thank you, Ms. Edwards.

We now turn to the former full Chairman, Mr. Hall.

Mr. HALL. I thank you, Mr. Chairman, and I really do think if we are having this hearing and working together, and if I understood your purpose, it is a little bit different to the five minute dissertation that Mr. Waltzer just gave us. It is not about gigawatts or anything else that he wants to decide but I think yours is about honesty and whether or not the EPA has been honest with this Committee and honest with the people. That is the first thing I say.

I also admire Mr. McConnell, who chose truth as his purpose and his pursuit, and he is here with us today, and I want to point out that we did have hearings from the EPA during the time of my chairmanship. I think, Mr. Rohrabacher, we had them two or three times before us, and each time they testified for days and went all over the country looking for someone that would testify that fracking was ruining the drinking water, and if you are looking for honesty you can check them on that because either Mr. Rohrabacher or I asked the four who were administrative witnesses that came here, each of them testifying to the dangers of that, and the liberal press talking about the dangers of it. We asked this question in closing: can you tell us anywhere in the United States where fracking has ruined one glass of drinking water. Each of the Administration witnesses said no, all four of them. That is a record. You don't have to have somebody come in here and testify to that again. It is a record. They themselves said that. So they are not being honest with us, and I think if we get a President that will appoint a secretary of some of his administrations that will follow the law, why, we will take a good look at some of their testimony when they come before us and testify under oath, and they were reminded that they were under oath, that they were operating from the best science.

Let me get to something a little more. This hearing sheds light on the technological basis for the EPA's conclusion that CCS has been "adequately demonstrate" in its proposal that CCS should be required for new coal-burning plants. Once again, the testimony has shown that the EPA's proposed mandate reflects flawed judgment again. I might ask you, Mr. McConnell, if you would like to expand on that.

Hon. MCCONNELL. Well, just to be brief, when something is mandated and determined to be technically demonstrated, commercially available and it isn't, that makes it impossible for industry to make an investment, and by virtue of that, it will eliminate the ability to build new coal generation in this country. And maybe more importantly, as we think about a global word that the energy is going to double over the next 50 years, to get that technology to other places in the world is incredibly important because this is a global issue, not just a U.S. issue.

Mr. HALL. And I thank Chairman Lummis, who wished the EPA could be here and be here and testify again for you all to hear. I don't know how much time I have left, Mr. Chairman, or I have run out of time——

Chairman STEWART. You have got about a minute and a half.

Mr. HALL. All right, sir. Mr. McConnell, we in Texas are very proud to be leaders. Mr. Weber got onto that, and I certainly agree with his approach. I like the way he identified some of the President's promises. But the Texas Clean Energy project is a "now gen." It is integrated classification combined cycle facility that will incorporate CCS as a commercially clean coal power plant, and it is my understanding, and I may be wrong, that this project received a $450 million award in the 2010 from the Department of Energy's Clean Coal Power Initiative and received a final air quality permit from the Texas Commission on Environmental Quality in 2010. My question, I guess, once again, is to you, Mr. McConnell. Has this project begun?

Hon. MCCONNELL. No, sir. There has been no ground broken and no construction.

Mr. HALL. What are some of the challenges associated with it?

Hon. MCCONNELL. The commercial viability as well as the concerns about the demonstrated technology have made it incredibly challenging to enable commercial realization, and that has delayed the start of that plant and construction for a considerable amount of time.

Mr. HALL. And my last question. What about the status of other plants, CCS projects around the country? How far along in construction are they?

Hon. MCCONNELL. Outside of the Kemper plant that has been mentioned several times, none of them are operational or in construction, and every one of them require government subsidies at this point because of the technology readiness and commercial availability.

Mr. HALL. Once again, I thank you, and Mr. Chairman, I thank you very much for having this hearing based on seeking honesty from people who come before us to testify. Thank you. I yield back.

Chairman STEWART. Thank you, Mr. Chairman.

We now turn to Mr. Massie.

Mr. MASSIE. Thank you, Mr. Chairman.

I have just a quick question for all of the witnesses. For given kilowatt-hour or gigawatt-hour production plant, if we had a typical state-of-the-art coal-fired plant and we had the same plant but hypothetically with CCS technology, and I say hypothetically because it doesn't exist yet, the two plants producing the same amount of energy, one has CCS and one does not. For each of the witnesses, which one burns more coal? Mr. McConnell?

Hon. MCCONNELL. To produce the same amount of electricity, the one with the CCS facilities obviously because of the parasitic load.

Mr. MASSIE. Dr. Bajura?

Dr. BAJURA. I concur with the Secretary.

Mr. MASSIE. The one with CCS burns more coal?

Dr. BAJURA. Yes.

Mr. MASSIE. Mr. Waltzer?

Mr. WALTZER. Yes, I agree.

Mr. MASSIE. What do you agree with?

Mr. WALTZER. The one with CCS burns more coal.

Mr. MASSIE. And Mr. Martella?

Mr. MARTELLA. I agree.

Mr. MASSIE. So we are all in agreement that CCS technology makes a coal plant less efficient. Do all the witnesses agree with that?

Hon. MCCONNELL. Yes.

Mr. MASSIE. So I think that is important to start out there. Now, the coal companies—and let me tell you why I am motivated to ask these questions. I am from Kentucky. We are very proud of our electric generation in Kentucky. I don't have any coal mines in my district yet we have two electric arc furnaces. One produces stainless steel, one produces steel. Kentucky is a big producer of aluminum. And so this is not about coal for me per se, this is about affordable domestic energy, and this is a very serious step when we increase the cost of domestic energy.

Mr. Waltzer, how much more costly per kilowatt-hour would it be to produce electricity with CCS?

Mr. WALTZER. Our study that we submitted in testimony indicated that to comply with this rule, a new coal plant today would be about $100 per megawatt-hour, and the——

Mr. MASSIE. On a percentage basis, what would it be? How much higher to produce?

Mr. WALTZER. Well, and that was without CCS, and then the one with CCS would be 113, so it's 13 percent higher.

Mr. MASSIE. You are saying 13 percent. We had a witness just about a month ago from the DOE say it was about 50 percent higher, and so is that because it burns more coal? Is that one of the reasons?

Mr. WALTZER. So yes, and I can explain the difference between those——

Mr. MASSIE. That is all right. I just wanted to check. And how much more coal does it burn to do CCS?

Mr. WALTZER. Well, you—I would have to go back——

Mr. MASSIE. At the 40 percent level, the Administration would receive reduction, correct?

Mr. WALTZER. Depending on if it is 13 percent or 50 percent, which number you are looking at, the amount of coal you have to burn is proportional to the percentage of energy penalty that you are paying.

Mr. MASSIE. So what is the number to achieve the 40 percent reduction?

Mr. WALTZER. I would have to go back and do the math but it is—it could be—I don't know. I don't want to speculate. I would have to go back and do the math.

Mr. MASSIE. So the coal-fired generation plants in my district have done a tremendous job of decreasing sulfur emissions. Particulate, mercury, all of these things have gone down by probably a couple orders of magnitude in the last 3 decades. But it still remains a fact, does it not, that those emissions are proportional to the amount of coal burned?

Mr. WALTZER. If I understand your question correctly, is there an energy penalty on those pollution controls? Absolutely.

Mr. MASSIE. What I am saying is, when you burn more coal, do you emit more sulfur for any given plants?

Mr. WALTZER. It depends on the pollution control.

Mr. MASSIE. Let me ask that question to Mr. McConnell. For a given pollution control on a plant, if you burn more coal, does it emit more sulfur?

Hon. MCCONNELL. Yes, and it would require more handling and more treatment to process that sulfur, yes.

Mr. MASSIE. So all things being equal, the effect of implementing CCS technologies is, we are going to burn more coal, and with the same emissions controls on mercury, particulate, sulfur, NOX, we are going to be admitting more of those, given the Administration's goals?

Mr. WALTZER. That is not necessarily correct. In order to——

Mr. MASSIE. But given the same technology for all of those things, it looks to me like it would be the same. Let me also ask you—I want to move on. I have 26 seconds. Will we have to mine more coal to produce the same amount of power?

Mr. WALTZER. Yes.

Mr. MASSIE. So all of the externalities that the Administration associates with mining coal would be increased with CCS?

Mr. WALTZER. Potentially.

Mr. MASSIE. Mr. McConnell, would you like to comment on that?

Hon. MCCONNELL. I might suggest there may not be any coal mined at all because in fact, the plants will shut down and there won't be any need for coal.

Mr. MASSIE. That is my concern. We have a plant in Kentucky that is shutting down. It is going to affect 139,000 consumers of electricity in my district, so I think it is a very important point to make, that CCS is not without costs to the environment. Thank you.

Chairman STEWART. Thank you, Mr. Massey. We now turn to the gentleman from North Dakota, Mr. Cramer.

Mr. CRAMER. Thank you, Mr. Chairman, and thanks, members of the panel, for being here. It is hard almost to know where to begin. I have heard so many things this morning. But I am going to start with addressing from the North Dakota perspective this issue of whether or not New Source Performance Standards for new plants affects jobs in the existing plants, and let me assure you, it does because it is a further reflection of an attitude that has been pervasive by this Administration that tells anybody interested in fossil fuel development, we are going to punish you as much as we can, and so if you are considering building a new plant or retrofitting an old plant, the odds are against you, and it is not like it has been a hidden agenda. It has been a pretty far-out-there agenda.

I appreciate as well—I am going to use this opportunity to put a few things into the record—that Mr. Waltzer has referenced several times the Dakota gas syn fuels plant at Beulah, North Dakota. I had the opportunity as an energy regulator for ten years not only to oversee electric rates but coal mining and pipeline development, and I sited the CO_2 pipeline, much of it, that goes to Saskatchewan, and we are very proud of that project. The company that owns it, Basin Electric Power Cooperative, which is one of the largest G&T cooperatives in the country, also owns a lot of electric gen-

eration, coal combustion generation, right near Beulah, and they engage with their own money in a demonstration project, 50 percent funded by Basin Electric's members and 50 percent funded by the State of North Dakota through a tax on coal, and concluded after the feed study that it was in fact not demonstrated to be economical to do a carbon capture and sequestration project at this time, and this is in a community right on the edge of the Balkan where there is a lot of commercial application for CO_2 should it enhance oil recovery. Obviously, all the incentives are there, and yet even at that, they concluded by their study that it was in fact not feasible to do it. So I want to put into the record, Mr. Chairman, with your permission and the permission of the Committee, a number of documents referencing this feed study by Basin Electric, if that is acceptable.

And then I have a question for the panel because I think there is some premise for this. When we talk about this adequately demonstrated standard and other standards in previous Clean Air Act rules, whether it is SOX, NOX, mercury, that have applied certain standards, has there been a different or is there a benchmark or some historical lesson we can learn from previous rules and the availability of technology at that time versus what we are facing today? Is that a fair characterization for a reasonable question, Mr. McConnell, and would you be able to answer?

Hon. MCCONNELL. I think there is an interesting model to look back into the 1970s when we were all concerned about SOX, NOX, mercury and suspended particulate. The government and industry formed a successful partnership together, not at odds with each other but partnered with each other, to develop technology to reduce those criteria pollutants by 90 percent over the next 40 years while we increase the amount of coal-generated power in this country by 200 percent, and that is through the miracle of technology. And in fact, I would hope that as we look to the future, we don't get simply bounded by what we know today in terms of performance and capabilities but we are mindful of the fact that the investment for the future is really where we will be and will need to be, and I certainly hope that rulings such as this don't promote a partnership between government and industry. They promote an adversarial circumstances and tends to block out an opportunity to advance coal, not promote it.

Mr. CRAMER. Doctor, would you agree?

Dr. BAJURA. I have concerns about the scale that we are talking about. I don't think the earlier technologies were as expensive as what we are discussing here, the earlier commentary about an energy penalty of 30 percent. It costs a lot of money when you are talking about a billion dollars per plant in excessive coal use. I agree with the Secretary. We need to find a way to move forward if we are going to solve this problem, and I think government support is essential.

Mr. CRAMER. With just the few seconds I have, Mr. Waltzer, if you could just answer this. You made reference to making coal cost more, and I am going to paraphrase it. You are going to have to straighten it out for me. But you are saying that this actually benefits the coal-generated electricity by positioning it well for when

gas prices rise. Could you elaborate a little bit on that, how making it cost more positions it better should gas prices rise?

Mr. WALTZER. So let me be clear. I don't know what gas prices are going to do. They may go up, they may go down, but if we take this first step to begin the process of deploying CCS technology and pushing it further down the cost curve, that will benefit coal in the future.

Mr. CRAMER. I see. I am out of time. Thank you, Mr. Chairman.

Mr. WEBER. [Presiding] Thank you, Mr. Cramer.

Mr. CRAMER. If I could, Mr. Chairman, I don't think it has been ruled on, my request to place into the record these documents from Basin Electric.

Mr. WEBER. Without objection.

Mr. CRAMER. Thank you.

[The information appears in Appendix II]

Mr. WEBER. We are going to get our act together up here Dana. We just don't know when, but the gentleman from California is recognized for five minutes.

Mr. ROHRABACHER. Thank you very much. I have been running back and forth between hearings today. As usual, they schedule two of the most important hearings that I am interested in at exactly the same time, so I am sorry if I ask something that is repetitive that had been asked earlier.

I would like to ask Mr. Martella, you had mentioned earlier in your opening statement that there was a court decision, Massachusetts, that the Supreme Court decided that the EPA has to consider or may consider CO_2. You said "has to consider." Does it say that they have to consider the CO_2 or just may?

Mr. MARTELLA. The way I interpreted the decision is, they have to consider greenhouse gases but they do not have to regulate them. The court made it clear, it was not forcing EPA to regulate greenhouse gases but it did have to consider——

Mr. ROHRABACHER. That is really an important distinction, and certainly, the Court did not mandate that they take steps to take the CO_2 out of energy production, did they, or did they say that has to be considered but they didn't say they have to do it? Is that right?

Mr. MARTELLA. You are absolutely right. It is an important distinction. The Court said the EPA can't ignore the consideration of greenhouse gases but the Court also explicitly said we are not telling EPA it must regulate greenhouse gases, just that it has to look at——

Mr. ROHRABACHER. So this is not a mandate by the Court. That is something we have to understand. What we are talking about is a policy that has been determined that this is the direction that the Executive Branch wants to go because that is what they have determined is consistent with their policy goals, not necessarily with what the Court is saying, not in contrast to the Court but not in direction mandated by the Court.

Carbon sequestration—now, I know you have had this question a number of times so I am assuming that you all agree that the CCS costs a lot more than if you didn't have to do that. Is that correct? I mean, everybody agrees to that. And let me note, our colleague, Ms. Edwards, who I deeply respect, from Maryland—I wish

she was here now—talked about the EPA's responsibility for public health and environment. Well, most of the people who support this idea that we are going to do something about the CO_2 and sequestration are thinking that it is being done, it is a pollutant and they are doing this in the name of protecting health. Now, am I correct that CO_2 is not a threat to public health? Does the panel agree with that? CO_2 does not affect human beings in the process of producing electricity. Is that correct? Is there some disagreement on that? I have been through many panels on this now. You would be the first one.

Mr. WALTZER. So CO_2 is not toxic but the temperature increases associated with greenhouse gases——

Mr. ROHRABACHER. That is a different matter, okay? So CO_2 is not toxic. It is not a pollutant. But we are going to spend a lot more money on it because we have the global warming theory that basically CO_2 will affect the climate of the planet. But most of the people and the public who are looking for more. They are looking at expenses now, especially when we are in this deficit. They are actually operating under the thought that what is happening with sequestration, etc., is being done to protect their health. Well, that just isn't the case. That is not the case what we have just heard. It is based on a world climate theory, not on a personal health concept, that we have to protect people's health.

Let me just note that what we have just heard with the talk from Mr. Massey is that not only is this whole sequestration not being done in order to protect public health, but by his questioning, he made it clear, and from what your answers were, that it is actually detrimental to the public health because you are increasing the level, the amount of sulfur, mercury and other particulates, etc. that are going into the air because now you are actually——

Mr. WEBER. Will the gentleman yield?

Mr. ROHRABACHER. Yes, I certainly will.

Mr. WEBER. And I will give you some extra time. Unless the end goal is to do away with the coal industry. I yield back.

Mr. ROHRABACHER. All right. Well, I think that sometimes people are not totally upfront about what their end goals are, but we have to look at the policies they are advocating today, but I would say that what we have heard at this hearing today indicates that the Administration is rushing forward full steam ahead on this CO_2 sequestration as part of an energy production guide states in a way that will actually damage public health but is consistent with their goal of trying to have a policy that affects the climate of the entire world, which I might add, is a very questionable theory and is getting more skeptics every day on that theory.

So thank you very much, Mr. Chairman.

Mr. WEBER. Thank you.

And I thank the witnesses for being here today, and that concludes——

Ms. BONAMICI. Mr. Chairman, if I may? Thank you very much for yielding for just a moment. There were some documents that were introduced today at the hearing that we did not see before, staff was not given ahead of time, and I would like to request that all staff remind Members that it is helpful to get those ahead of time so that we can raise appropriate objections, if any. So I just

wanted to put that reminder on the record, that it is important for us to see the documents ahead of time rather than for the first time at a hearing. Thank you very much.

Mr. WEBER. Thank you, Ms. Bonamici. I appreciate that.

And with that, this hearing is concluded.

[Whereupon, at 12:07 p.m., the Subcommittees were adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by The Honorable Charles McConnell

Chuck McConnell QFRs

Questions from Chairman Stewart:

1) **In 2008, the FutureGen project was nearly scuttled due to skyrocketing prices, including steel prices. Should we be concerned that the federal government is mandating use of a technology that DOE itself has had so much trouble developing at full commercial scale?**

We should be concerned that taxpayer dollars are continuing to be used to support FutureGen. The cost-creep that has occurred with this project is staggering, and none of industrial participants has shown a willingness to put any more of their own equity into its development. But the federal share of this project continues to increase. In fact, industry is pushing for more federal support. Last year when I served as the Assistant Secretary for Fossil Energy at DOE, I refused to sign a novation agreement because I did not believe that increasing the federal share up to 99 percent was appropriate.

The biggest reason why the FutureGen project does not have industry support is because it does not include any utilization of the CO2 being captured. Instead, the CO2 is stored as a waste product, which increases costs. Without enhanced oil recovery or utilization, the project economics are horrible and continue to get worse. The economics of power produced are bad and completely out of scope with the rest of the market. I do not believe the project has any chance of being completed as originally conceived. Absent political forces and given the dismal business plan, the project should have been dead several years ago.

The EPA NSPS regulations mandate a use of technology that essentially sets performance standards at the current level of natural gas combined-cycle plants. Alternate technologies, like the coal gasification in FutureGen, will be required to achieve the same standard. Several other coal gasification projects are performing well because they employ CCUS technology. The flaw for FutureGen is not wholly in the technology. A large part of the flaw is in the business development that does not take into account the low cost of traditional coal-fired plants in Illinois. One of the lessons learned from FutureGen is that we must develop workable business models, which right now require EOR and utilization of CO2, and second- and third-generation technologies to lower costs and make CCS/CCUS viable in the marketplace.

We should be concerned that with the NSPS regulations, the EPA has essentially picked winners and losers. EPA has chosen a technology and a means of power production for our country that defies the Administration's purported "All of the Above" strategy.

2) **EPA claims it can mandate CCS because the "components" have been demonstrated at facilities other than power plants. Yet, just two years ago, EPA co-authored a report that concluded, "Since the CO2 capture capacities used in current industrial processes are generally much smaller than the capacity required for the purposes of GHG emissions mitigation at a typical power plant, there is considerable uncertainty associated with capacities at volumes necessary for commercial deployment." Which EPA is right – the one that concluded there is substantial uncertainty concerning CCS at power plants, or the one that is now mandating CCS at power plants?**

Two years ago, the EPA got it right when they made the statement about the uncertainty of commercial deployment. There is absolutely no question that there is considerable concern with mandating CCS technology – a technology that is not employed at scale anywhere in the world. To mandate its use with any level of assurance that the technology is ready for commercial deployment is ludicrous.

3) **What is the difference between regulations that incentivize carbon reductions and regulations that mandate CCS? Does the latter push coal technology beyond where companies can feasibly use it?**

There is a huge difference in approach between regulations incentivizing and mandating CCS. The latter is punitive. Mandating CCS assumes the technology is demonstrable and ready, but it is not. Mandating a standard that requires the use of a technology that is not commercially viable makes it impossible for industry to choose that source as an option. In fact, such a mandate requires industry to choose another means of producing power. It is environmental manipulation of the marketplace that takes part of our energy mix off the table, which is not healthy for energy security or an energy portfolio that is fixed on "All of the Above."

Currently, many believe that natural gas can replace coal as a cheap, clean source of power production in this country. Historically, natural gas prices have fluctuated, and they will continue to do so in the future. The power industry is not choosing to use natural gas as a source because it is cheap. They understand the expected price fluctuations. Industry is choosing natural gas because it cannot chose coal due to this type of regulation.

On the other hand, regulations that incentivize carbon reduction will drive technology choices and commercial pathways to better performance. Those regulations will push

industry to achieve more creative processes and projects that will benefit the marketplace and environment, giving us more options for cheap, clean power production.

4) **EPA's cost-benefit analysis that accompanied this proposed rule stated that these standards "will result in negligible CO2 emission changes, energy impacts, [and] quantified benefits..." President Obama's executive order on regulations requires that for any regulation, the benefits must justify the cost. In light of the absence of benefits associated with this proposal, do these new standards meet the President's cost-benefit requirement?**

No.

5) **Are there any states or districts in this country in which using carbon capture and sequestration for the purpose of enhanced oil recovery is not feasible?**

Yes. There are geology issues that will either allow certain areas to be receptive to EOR or exclude certain areas from EOR use. CCS is not a solution that can be universally applied, nor should it be thought of as such. In the same manner that solar, wind, and nuclear energy sources are not a suitable fit for all 50 states, neither is EOR. However, it is an important component of a real All of the Above strategy. We need to ensure that there are suitable regional options for best choices in power production and supply of market across the country. No technologies or sources are the answer for all 50 states – including CCS. For instance, EOR will not work in the geology of the Northeastern United States. Similarly, hydro is not a viable choice for Florida. But solar might work there, when it will not work in Maine. Giving up pieces of our country's energy portfolio narrows options and forces our country into less attractive long-term cost and energy security choices.

6) **In your testimony you referenced the complicated series of interrelated EPA rules and regulations currently being enforced, promulgated or contemplated. What specifically were you referring to, and what is the risk these actions may pose to coal-fired plants?**

INSERT EPA REGULATORY TIMELINE CHART

The attached diagram illustrates my point. The mix of rules (in place, being promulgated, or contemplated for regional, national and adjacent state areas related to

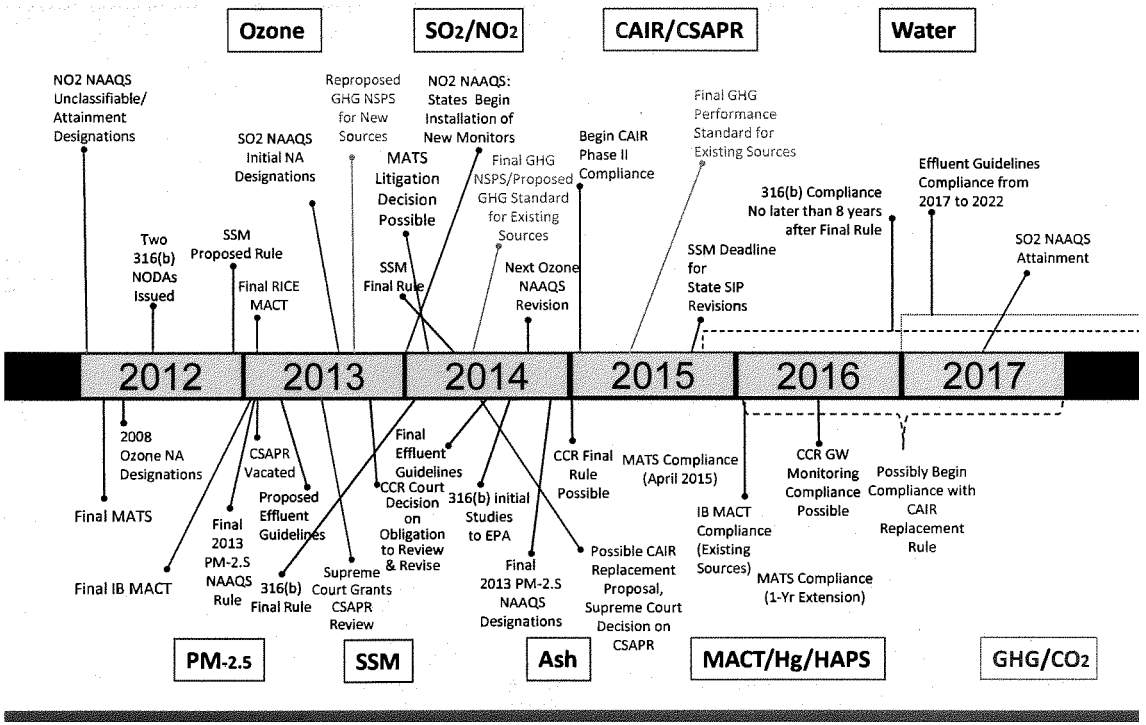
NOx, SOx, Mercury, particulate, CO2, and ash, among others) places an extreme burden for industry to plan for or calculate risk for new coal-fired power plants. This burden pushes them to pursue other technologies and will lead to an end of coal as a source for power in this country.

Questions from Representative Neugebauer:

1) **In July, I asked Mr. Chris Smith, the Acting Assistance Secretary of Fossil Energy at the Department of Energy, about the timeline for the development of CCS technology. At that time, he could not give me a set timeline for when this technology would be truly ready for commercial use. Numerous states have determined that CCS is not economically or technically feasible for power plants, and the EPA itself stopped short of saying CCS was adequately demonstrated in April of 2012. What has changed substantively in CCS development in the last year and a half?**

The only thing that has changed substantively in the last few years is this Administration's willingness to abide by its own plan for the development and deployment of CCS technology. The Administration is cutting its internal budget for the programs outlined in the 2010 CCS R&D Roadmap. But the technical steps laid-out in the Roadmap necessary for the development of scalable CCS technology have not changed. The 2010 Roadmap called for a ten-year funding and development program with demonstration plants utilizing today's technology. The Roadmap planned for second generation technology to be deployed beginning in 2020. In 2025/2030, third generation/transformational technology would further drive cost down and make it commercially viable. To achieve the targets envisioned for technology deployment, specific research and development funding requirements must be met, but the R&D budget supporting this work has been cut by 40 percent. This underfunding threatens our ability to achieve adequately demonstrated CCS technology – which the Administration's plan, if perfectly implemented, expects would not occur before 2020. The EPA apparently failed to read the 2010 Roadmap before issuing its NSPS proposed rule, and it certainly did not take into account the underfunding of federal R&D efforts, which will only further delay our ability to achieve the 2020 goal.

EPA Regulatory Timeline



Responses by Dr. Richard Bajura

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Subcommittee on Environment
Subcommittee on Energy

Hearing Questions for the Record
The Honorable Chris Stewart

EPA Power Plant Regulations: Is the Technology Ready?
Dr. Bajura

1. Dr. Bajura, help me better understand what you mean by "Scaling up technology?" What are the challenges in moving from a demonstration to full-scale commercial applications?

2. The EPA contends that use of the "component pieces" of CCS in various applications means the technology is adequately demonstrated for power plants. Can a technology system be considered adequately demonstrated and commercially available if the entire system has never been used at commercial operating scale before?

3. EPA cites three studies in the "literature" section of the new standard's "technical feasibility" discussion of CCS. Yet, EPA leaves out that one of those studies concludes that "there is truth to the often heard assertion that CCS has never been demonstrated at the scale of a large commercial power plant," another assumes carbon capture is "unproven technology" and the other – which EPA co-drafted, no less – says that carbon capture has "not been demonstrated at a scale necessary to establish confidence for power plant application." Does EPA accurately portray the science on CCS when it cherry-picks from studies in this manner?

4. In your opinion, is CCS technology today directly comparable to the technological development of scrubbers in 1980 when their use was first mandated by EPA by rule?

5. Has EPA ever adopted an emission standard that depends on ancillary activities that are not part of the normal operation of an emission source?

Responses

Question 1: Scale-up of Technology

In advancing a technology based on a constructed facility from its initial formulation to commercial deployment, much experimentation must be done. The first such experiments are usually done in a small laboratory apparatus to validate that the base hypothesis about the operation of the technology is sound. A laboratory reactor for testing a chemical reaction, for example, may be in a confined space with a volume of a pint of fluid. A commercial reactor may operate in a facility where the volume of the reactor space is five hundred barrels or more. The pint-sized reactor may cost $10;

the five hundred barrel reactor may cost a billion dollars. Before building the billion dollar reactor, the process is usually demonstrated in facilities of varying sizes from pints to quarts to gallons to barrels to hundreds of barrels in size. The process of proceeding from a small reactor to a commercial reactor by building test systems of larger and larger sizes is called scaling.

Testing the process in a reactor of each of the sizes discussed above is a demonstration of sorts. The larger the scale, the more other factors come into play. For example, how would the plant owner manage the waste generated daily from a large scale process compared to small amount generated over the testing of the smaller system? What kind of safety precautions need to be taken when a large vessel is exposed to high pressure requiring a large wall thickness versus a small vessel at low pressure where a thin wall tube is sufficient protection? What are the economics of the large scale system compared to competing technologies? In some cases, the performance of the full scale system may be reduced compared to the smaller versions due to the extra complexities that come into play for larger systems.

Proceeding from a small scale to a demonstration scale (usually one-third or smaller in size than the commercial version) involves taking into account factors that are non-existent or can be handled by over-building a small scale system but become large factors regarding weight, safety, or economics in a larger system. In the end, if the commercial system cannot demonstrate that it will operate economically, that it will meet performance guarantees, and will meet environmental regulations, such a system will not achieve commercial status.

Question 2: Component Testing versus System Testing

As discussed above, the larger the scale of a device, the more complex the system becomes. Many components in industrial systems were designed and tested for particular applications. These components operate effectively in the environment for which they were designed.

However, if a component is placed into another system operating with different inputs to the device and different output requirements, the device may not operate to the specifications required for the overall process. The performance of all components in a system must be effectively integrated into the overall system in order to assure an overall acceptable system performance. An effective design must have not only acceptable performance from each component, but acceptable performance of the overall system.

When a technology has not been demonstrated to perform effectively under the conditions required of a commercial system, it is difficult to find fabricators who will guarantee performance since the fabricator will pay the buyer each day over the lifetime of the unit for extra costs to the owner for performance metrics that were not met. If a fabricator will not build the device due to uncertainty in performance, it can be said that the technology is not yet developed to a commercial scale.

Question 3: Data Used by EPA in Setting Standards

I have not studied all the reports reviewed by EPA nor the general literature in the area of carbon capture for CCS applications. Often times studies appear to be similar in nature, but on inspection of all the parameters tested, there may be small differences in design or operating conditions which can change the performance of a system as discussed with respect to Question 2 above. It is

necessary to carefully review the conditions under which a technology has been tested or demonstrated to be able to accurately predict its performance in a different application.

Question 4: Status of CCS Technology Compared with Scrubber Technology

Engineering studies have been performed on devices that are called First-of-a-Kind systems versus Nth-of-a Kind Systems, where N is a number much larger than one. These studies show that as one constructs newer and newer versions of a technology device, lessons are learned about the basic operation, or the construction schedule, or the material properties needed, such that it is possible to reduce costs and improve performance over time. With investments in carbon capture technology and larger scale demonstrations, the performance of carbon capture technologies currently available will improve and costs will be reduced. These effects were shown to be the case for scrubber technology development and deployment.

When technology is mandated by rule, as in the case of regulations by EPA, it is important that sufficient time be given to develop technology with the required performance and that the performance goals be set at realistic levels given the time frames required to prove out technologies developed to meet the standards promulgated by the rule. The pathway to commercialization of CCS technologies should follow a similar pathway as was noted for the development of technologies for criteria pollutants. However, the time frame for development of CCS technologies is likely to be longer given the complexity of the process in needing both capture and storage technologies to be developed at large scales. These factors are reasons why I consider the state of development of CCS technologies to be behind the corresponding state of development of technologies such as scrubbers for sulfur or for other criteria pollutants at the time similar legislation was enacted mandating control of the given effluent emitted.

Question 5: EPA Standards

I am not sufficiently familiar with EPA's procedures for setting standards to provide a response to this question.

Richard Bajura

February 18, 2014

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Subcommittee on Environment
Subcommittee on Energy

Hearing Questions for the Record
The Honorable Randy Neugebauer

EPA Power Plant Regulations: Is the Technology Ready?
Dr. Bajura

1. In July, I asked Mr. Chris Smith, the Acting Assistant Secretary of Fossil Energy at the Department of Energy about the timeline for the development of CCS technology. At that time, he could not give me a set timeline for when this technology would be truly ready for commercial use. Numerous states have determined that CCS is not economically or technically feasible for power plants, and the EPA itself stopped short of saying CCS was adequately demonstrated in April of 2012. What has changed substantively in CCS development in the last year and a half?

Responses

Question 1: Changes in CCS Technology Development

I consider there to be two important technology developments that factor into the use of the term "CCS", meaning carbon capture and storage. Carbon capture occurs at the power plant. Storage is usually done in an underground reservoir. These two aspects, capture and storage, employ two different technology approaches and are coupled in that once the CO2 is captured, it must be stored. The coupling is usually considered to be a pipeline that takes the CO2 from the source to the sink.

Carbon capture technology is well developed in the chemical engineering field. In the production of chemicals, it is sometimes necessary to remove CO2 from the process stream. Hence, CO2 removal technologies were developed by the chemicals industry. While the cost of these technologies is high, the value of the product manufactured is high enough that the capture cost can be recovered in the selling price. In the case of carbon capture in a power plant, the current technologies (e.g., amines or chilled ammonia processes) that are available can remove CO2, but the cost of operating systems is high and the resulting selling price of electricity is greatly increased. Recently, DOE Office of Fossil Energy personnel testified that capture costs could be as high as $90 per ton of CO2 captured and that the cost of electricity for such plants

could be almost doubled. Electricity produced using these technologies is not cost competitive with electricity produced by, say, natural gas without carbon capture. Hence, while the technology is available to capture CO2, the cost is so prohibitive that systems based on these technologies will not be used commercially. Since commercial deployment for a technology is based on its effectiveness at performing the required task and its cost competitiveness compared to other processes, many states have determined that this part of the CCS requirement is not economically feasible.

Over the past several years, new technology pathways to capture CO2 have been proposed. One way to improve capture technologies is to improve cycles. Recent studies have shown that processes such as ultra-supercritical pressure coal power systems, oxygen-fueled combustion systems, and chemical looping systems offer promise to reduce the cost of capture compared to existing technologies. Additional research is needed for these technologies to validate their effectiveness in the commercial market. Other advanced cycles are also being studied which may result in even greater performance of the capture component of fossil fuel power generation. These new technologies have emerged in the past two years as having promise and worthy of further investigation. However, development of the technologies for commercial application is complicated by the absence of federal funding to do demonstration projects and the uncertainty of future construction of coal power plants in the face of the proposed NSPS rule for new coal plants. Hence, developing a timeline for deployment is a difficult task.

Turning to the issue of storage in the parlance of CCS, it is necessary to demonstrate that carbon can be injected into underground saline reservoirs, for example, in a manner that will not be detrimental to the environment in the near term and in the long term. Such research programs have not been conducted and evaluated for applications such as would be applicable to a large (600 megawatts) power plant operating over a long period corresponding to the typical lifetime of the plant. Injecting carbon underground is not cost effective – it costs money to do and there is no apparent benefit. Some offsets in cost can be obtained by injecting CO2 into oil reservoirs for enhanced oil recovery operations. But the costs of recovered oil do not offset the operational costs of capturing the CO2 at the power plant. We need additional work to prove out the safety and performance of underground reservoirs to gain acceptance by the general public while demonstrating the effectiveness of injection schemes. Proving out schemes for injection that need to be tested over a large number of years to demonstrate permanent, safe storage is not a program that can be completed in several months. Hence, timelines for deployment of commercial storage technologies is also difficult to predict.

Our nation needs a steady, robust program of technology development both for carbon capture and storage to prove out these new technologies. By supporting a strong program of research, we can develop cost-effective technologies for both capture and storage and then be able to confidently predict times for deployment of advanced technologies. I recommend continued support for coal based research programs to ensure that coal remains in the national energy mix since it is a highly abundant energy resource.

R. Bajura

Responses by Mr. Kurt Waltzer

U.S. HOUSE **OF REPRESENTATIVES**
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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Hearing Questions for the Record
The Honorable Randy Neugebauer

EPA Power Plant Regulations: Is the Technology Ready?

Mr. Waltzer

1. In July, I asked Mr. Chris Smith, the Acting Assistant Secretary of Fossil Energy at the Department of Energy about the timeline for the development of CCS technology. At that time, he could not give me a set timeline for when this technology would be truly ready for commercial use. Numerous states have determined that CCS is not economically or technically feasible for power plants and the EPA itself stopped short of saying CCS was adequately demonstrated in April of2012. What has changed substantively in CCS development in the last year and a half?

Response:

We maintain that CCS is an adequately demonstrated technology today. As noted earlier in my written testimony, this is based on a long history of the technology and its components:

• Large, integrated CCS projects began in the United States in the 1970 and 1980s at industrial facilities where C02 was sold for enhanced oil recovery (EOR). Some of these projects capture and store 1 million tons C02 per year,5 million tons C02 per year, and 7 million tons of C02 per year.[1] From its beginning in industrial facilities, CCS has migrated to power plants where it can reduce C02 emissions by greater than 90%.

• In early 2012 there were 127 U.S. C02 EOR projects with approximately 7,100 C02 injection wells and 10,500 producing wells. According to the National Petroleum Council, approximately 3 billion cubic feet per day of C02 (57 Mt/yr) of newly purchased C02 are presently injected for tertiary EOR producing 286,000 barrels of oil per day (105 million barrels per year

• Nearly 1 billion tons of C02 have been stored underground in U.S. oil fields from EOR operations over the last 40 years. In its 2013 National Assessment of Geologic Carbon Dioxide Storage Resources, the U.S. Geological Survey assessed the technically accessible geologic carbon storage resources in 36 sedimentary basins in the onshore and beneath state waters of the United States. The assessment only inventoried geologic formations below 3,000 feet with adequate porosity and permeability to accept commercial volumes of C02. The assessment estimates that there are approximately 3,000 Gt of subsurface storage

[1] These include Val Verde natural gas processing plant, Enid Fertilizer project, Shute Creek natural gas processing plant, Great Plains Synfuels plant, Century natural gas processing plant

capacity. This represents more than 500 times the 2011 annual 5.5 Gt of energy-related C02 emissions in the U.S. today. In addition, DOE estimates that 500 to 7,500 Gt of C02 could be sequestered in all U.S. offshore formations on the outer continental shelf

• There are presently approximately 4000 miles of C02 pipeline connecting naturally mined and anthropogenic sources of C02 with enhanced oil recovery projects.

• Pre-combustion capture technology has been commercially available since the 1950s and 1960s. Two of the main technology options, Selexol and Rectisol, have over 100 plant applications each across the world.

• Post combustion capture has been successfully applied to exhaust gases from both natural gas and coal plants, with commercial guarantees offered from several vendors.

An adequate demonstration of the technology is different from the issue of whether or not a technology will be used absent regulatory or statutory requirements or incentives. For example, power companies will not add sulfur dioxide scrubbers unless they are required to do so, or it makes economic sense based on the sulfur dioxide cap and trade system.

In some cases, such as the addition of CCS at Southern's Kemper plant in Mississippi, the integration of CCS in the development of a new generation project and the use of enhanced oil recovery helped move the project forward. But even in states that clearly have a vested interest in CCS technology, a lack of clear regulatory limits creates deployment barriers. For example, in 2011, the West Virginia Public Service Commission considered AEP's request for rate-payers to cover AEP's portion (50%) ofthe cost associated with the 250 MW scale CCS retrofit project - with the remaining portion covered by a grant from the Department of Energy's Clean Coal Power Initiative. Unlike Kemper, the project was not integrated into a new power project, nor did it include EOR as a storage opportunity.

Nonetheless, the Commission did not reject the project outright, nor did it find that the project was not feasible based on economics or technology status. Instead, the
PSC stated:

"We are concerned about the future of CCS and the enormous potential that it might hold for West Virginia and our natural resources."

And,

"... as the CCS project is operating at a nominal level and is in fact sequestering some of the CO_2 from the Mountaineer Plant, we are willing to allow a proportionate share of those expenses to be included in operating expenses in this case. To be fair, as discussed above, we believe that this operating cost also needs to be shared among all AEP operating companies."[2]

Thus the WV PSC recognized the importance of CCS and on that basis offered to cover a portion of the costs requested for recovery by AEP, but in AEP's view, that was not enough to make the project viable. A lack of regulatory certainty created a barrier for the PSC agreeing to cover the full costs. As AEP stated at the time:

[2] Public Service Commission of West Virginia, Case No. 10-0699-E-42T, March30, 2011.

> "as a regulated utility, it is impossible to gain regulatory approval to recover our share of the costs for validating and deploying the technology without federal requirements to reduce greenhouse gas emissions already in place."[3]

While lack of regulatory certainty is a current barrier to CCS technology, it is encouraging to note that two CCS power propjets (Kemper, and SaskPower's Boundry Dam project) and one large-scale industrial project (Shell's Quest project in Alberta) are slated to finish construction and come on line in the Spring of2014. That CCS activity, just in the last year and half, is an example of an application of a technology based on a long history of industrial activity. Greater regulatory certainty is important for further technology deployment. Finalizing EPA's proposed New Source Performance Standards is a crucial and necessary step towards creating this certainty.

I will be pleased to provide any additional information or clarifications that you need, if any.

[3] "American Electric Power Puts $668 Million plan on hold", Charleston Daily Mail, July 15, 2011.

Responses by Mr. Roger Martella

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January 26, 2014

Honorable Chris Stewart
Chairman, Subcommittee on Environment

Honorable Cynthia Lummis
Chairman, Subcommittee on Energy

Committee on Science, Space, and Technology
2321 Rayburn House Office Building
Washington, DC 20515-6301

Re: Re: Response to Questions for the Record, "Hearing on EPA Power Plant Regulations: Is the Technology Ready?"

Dear Chairman Stewart and Chairman Lummis:

Thank you again for the honor to appear before your subcommittee to provide my views regarding the Environmental Protection Agency's New Source Performance Standards for Electric Generating Units. As I testified, I believe EPA's proposal raises significant legal and technical issues, and I commend the Subcommittee for addressing this issue at a critical time and look forward to assisting your ongoing efforts.

My responses to your questions for the record are below.

In your opinion, is CCS technology today directly comparable to the technological development of scrubbers in 1980 when their use was first mandated by EPA by rule? Has EPA ever adopted an emission standard that depends on ancillary activities that are not part of the normal operation of an emission source?

In short, the requirement in the proposed new source performance standard mandating carbon capture and sequestration (CCS) is unprecedented from both technological and legal perspectives. In the preamble, EPA itself acknowledges that CCS has not been demonstrated or operated at any commercial facility, regardless of scale. At the same time, EPA flatly contradicts itself by concluding this technology is "adequately demonstrated" for purposes of satisfying the legal standard in Section 111(b). Simply stated, both things cannot be true. While EPA fairly points out that case law over the years has added context to the meaning of "adequately demonstrated" technology under Section 111(b), it is arbitrary and capricious to interpret either

the provision or the case law in such an extreme way to require technology that has not been put to use in any demonstrated scenario (and that EPA acknowledges has never been commercially demonstrated), let alone require it on a commercial scale of the magnitude anticipated by the proposed Rule. The analogy to scrubbers is inapposite. At the time EPA mandated scrubbers, the technology had been proven and was in commercial use at the scale required by the rule, even if not widely deployed. The situation with CCS stands in sharp contrast to that scenario, with EPA itself conceding not a single electric generating unit is operating in the United States that deploys CCS. There is thus no sound legal basis to conclude that CCS is "adequately demonstrated" within the meaning of Section 111(b).

States are required to incorporate new source performance standards into their state environmental permits. Therefore, do you believe states would have standing to challenge these NSPS in courts once it is finalized?

States through public announcements and letters to EPA already have announced that the proposed rule will cause severe harm to their economies, citizens, businesses, and energy reliability if finalized. Certain states have identified impacts to utilities directly, which would increase the cost and jeopardize the reliability of energy, to the suppliers, providers, and transporters of coal and petroleum coke, and to industrial and residential consumers of electricity. Indeed, recently the state of Nebraska cited harm from the proposed rule itself in bringing the first challenge to the revised NSPS in federal court. These harms are sufficient to establish standing under Article III of the United States Constitution. In addition, the Supreme Court has held that states have "special solicitude" in establishing standing, which should further cement states' ability to satisfy the standing requirements in challenging the NSPS.

What are the implications of this new definition of the "Best System of Emission Reduction" (BSER)? Might it be used in other rules?

As described above, EPA's determination that a technology that is not commercially viable is nonetheless "adequately demonstrated" itself is unprecedented under the language of the Act, applicable case law, and past EPA practice. At the same time, this approach could have precedential impact beyond EGUs in several ways. First, as described below, the extraordinary stringency of these standards may set precedent for EPA's approach to guidelines for existing sources under Section 111(d), meaning that EPA could use a similar technology forcing approach to existing facilities. Second, it is anticipated that EPA will begin developing GHG standards under NSPS for other industrial and manufacturing sectors in the near future. EPA likely will rely on the approach it adopted for EGUs in establishing analogous standards for other sectors. Third, beyond greenhouse gases, EPA's unprecedented technology forcing approach could be cited in other NSPS for other types of pollutants as well, mandating a wide range of technologies under Section 111 that are not commercially demonstrated today.

Given the current state of the technology, if EPA identifies CCS as BESR for coal-fired EGUs, what would prevent EPA from finding that CCS is BESR for natural gas plants?

As the question points out, in the proposed NSPS, EPA identifies CCS as the Best System of Emissions Reduction (BSER) for coal facilities but not natural gas facilities. In recent months, certain groups have identified campaigns targeting new gas facilities from being constructed, despite their significant favorable greenhouse gas profile compared to coal. It would not be surprising--if not anticipated--that groups opposed to natural gas will make precisely this argument that EPA should require the same CCS technology for gas facilities that it does for coal. Thus it will be critical for EPA in the final rule to establish a firm record foundation for why it affirmatively believes that CCS should not be required for gas facilities.

EPA is under a consent decree to also issue NSPS on greenhouse gases for refineries in the near future. Do you think there will be an impact from this rule's definition of BESR? How might this affect the standards for refineries or for other manufactures? Do you think the new definition gives standing to companies in the oil and gas sector, so that they may challenge this rule? How about entities already under a NSPS like hospitals, grain elevators, and manufacturers? Could those entities have standing to challenge the GHG NSPS?

There are very few things that EPA does in a given rulemaking that do not flow over to and create precedent for other sectors and regulations. Thus, as pointed out by many of the manufacturing and industrial trade associations, there is significant concern that EPA's approach in this utility rule will create precedent for other sectors. Indeed, certain groups already are challenging PSD permits issued by EPA and other permitting agencies on the grounds that they do not incorporate CCS as BACT. There are numerous distinctions between how GHGs can be controlled from utilities and other sectors, as well as the ramifications of such regulations for energy intensive, trade sensitive industries, that must be considered and documented in this rulemaking to avoid this rule from spilling over into other sectors. EPA in the record should make it clear why proposed controls on utility GHGs have no precedential impact on other sectors for the reasons identified by these groups in their comments. Finally, there is no debate that other sectors will be impacted and harmed by this rule, including those that produce and transport coal and petroleum coke and those industries that rely on affordable and reliable energy. These industries, should they decide to challenge the NSPS, should be in a position to demonstrate these harms in establishing standing.

Can you explain the relationship between this rule and EPA's upcoming standards for existing sources? As you know, states have primacy in implementing standards for existing sources. Can you explain what this rule might mean for the Clean Air Act's cooperative federalist approach to establishing performance standards for existing power plants under Section 111 of the Act?

The relationship between Section 111(b) and 111(d) is largely unchartered waters. EPA has issued Section 111(d) guidelines for existing sources on only a handful of occasions. Both the Act and the limited precedent demonstrate that states are to have primacy in implementing the existing source standards in their states. First, the Act explicitly provides that states are the regulatory agencies that implement the 111(d) guidelines for impacted sources in their states and that states shall have sufficient flexibility in doing so. Second, unlike Section 111(b) standards for new sources, Section 111(d) requirements are guidelines, and not exacting standards, and thus EPA itself should have significant flexibility to offer states a toolbox of options in satisfying Section 111(d) as opposed to a one size fits all mandate. Third, it is also implicit—if not explicit—in Section 111(d) that states should have sufficient time to implement the Section 111(d) requirements once EPA issues its guidelines. Here, under the schedule announced by the Administration, the states will have one year to develop their Section 111(d) approach upon the release of the EPA guidelines in June 2015. That time likely will be inadequate for many if not most states, and these deadlines themselves could frustrate cooperative federalism if EPA decides to implement the guidelines directly if a state cannot meet the limited one year window. Finally, although not directly presented by the question, I would point out there is significant legal doubt that EPA has any authority to impose Section 111(d) standards for existing utilities. The plain text of the Clean Air Act says that EPA lacks authority to impose Section 111(d) standards for existing sources when those sources are subject to a Section 112 National Emission Standard for Hazardous Air Pollutants (NESHAP). Because EGUs are subject to the Utility NESHAP under Section 112, EPA lacks authority to impose Section 111(d) standards on them at the same time.

Has EPA resolved potential issues regarding the classification of compressed carbon dioxide as an acid gas under both Superfund and the Resource Conservation and Recovery Act?

Your question highlights one of the fundamental flaws in EPA's analysis for concluding that CCS should be required for new facilities as the "best system of emissions reduction." In the preamble to the proposed rule, EPA focuses exclusively on the technical feasibility of CCS without any discussion of regulatory, economic, and pragmatic roadblocks to deploying the technology on a broader scale. For example, as your question points out, there are significant unresolved issues regarding the regulatory and legal authority to inject carbon under national, state, and local laws. Similarly, EPA's analysis presumes that there are sufficient geological formations in proximity to new sources where CCS can be deployed. A "*system* of emissions reduction" means exactly that and requires the system and infrastructure to be in place for the required technology to be deployed. EPA should ensure that before it mandates new standards it considers not only the technological feasibility, but also the full suite and system of regulatory, economic, and pragmatic considerations that apply.

Response to Honorable Randy Neugebauer

In July, I asked Mr. Chris Smith, the Acting Assistant Secretary of Fossil Energy at the Department of Energy about the timeline for the development of CCS technology. At that time, he could not give me a set timeline for when this technology would be truly ready for commercial use. Numerous states have determined that CCS is not economically or technically feasible for power plants, and the EPA itself stopped short of saying CCS was adequately demonstrated in April of 2012. What has changed substantively in CCS development in the last year and half?

Your question fairly points out the flat inconsistency between EPA's conclusion in April of 2012 that CCS is not adequately demonstrated for purposes of Section 111(b) and its proposal in September of 2013 that CCS can be considered BSER for these same sources. EPA does not explain in the record the sharp change in its position over such a short period of time. This inconsistency and lack of rationale for the change in the record suggests that the change was one more based on a policy rationale to require CCS as opposed to any dramatic evolution in technology over this time frame.

***

I hope these questions are helpful in your efforts to continue to promote fairness, transparency, and public participation in settlements and consent decrees. I would be honored to offer any additional assistance to you and the Subcommittee.

Sincerely,

Roger R. Martella, Jr.

Appendix II

Additional Material for the Record

SUBMITTED BY REPRESENTATIVE KEVIN CRAMER

Fresh tech, difficult decisions

Basin Electric has a history of trying new technology

By Daryl Hill and Tracie Bettenhausen

Basin Electric has been the first to try many technologies. Just think of the cooperative's very first power plant, Leland Olds Station. When it went online in 1966, it was the largest plant in the Western Hemisphere to use lignite coal as a fuel source. And throughout its lifetime, it has been the proving ground for using and developing lignite.

More recently, the cooperative was the first to use GE's LMS100® simple cycle gas turbine at the Groton Generation Station in South Dakota.

Basin Electric staff prides itself in finding the best technology available. However, not every technology makes it past the first phases of study. Here's a look at some of the cooperative's latest ventures.

Lessons learned from carbon capture project

While the carbon capture project at Antelope Valley Station won't be going into demonstration phase at this time, benefit has come in the form of information – the first detailed analysis of carbon capture from a coal-based power plant in the region.

Basin Electric's directors decided in December that a proposed demonstration project to capture emissions of carbon dioxide (CO_2) at the Antelope Valley Station near Beulah, ND, will remain on hold until the economic viability of such a venture can be further developed.

This decision was made based on many factors including the results of a Front-End Engineering and Design (FEED) study presented at the December board meeting. The FEED study, which began in February 2010, focused on capturing a portion (about 25 percent) of the CO_2 from one of the Antelope Valley Station's two units. The FEED study, coupled with an assessment of the additions necessary at the plant, financing and sequestration costs indicated a demonstration-scale project could cost as much as $500 million.

Ron Harper, Basin Electric CEO and general manager, is satisfied with the effort. "The FEED study accomplished its purpose. This is the first time in the region a detailed analysis of a carbon capture project from a conventional coal-based power plant has been conducted," he says. "We now know the required infrastructure, the cost, and the integration and operational challenges that will be required to continue developing a carbon capture technology. In the current economic climate, we are postponing further investments for the time being, but regard it as important technology to consider for the future."

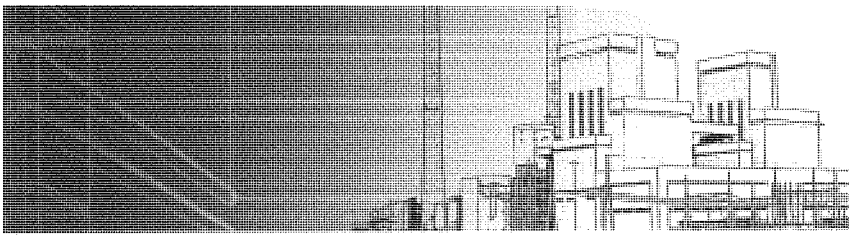
Harper says Basin Electric has been working on this project for more than three years and has made a huge investment in time, human resources and capital to come to this decision point. In addition to the overall cost of the project, other factors affecting the decision included:

- The market for the sale of CO_2 for enhanced oil recovery (EOR) is still developing in this region. Without EOR, additional costs for direct geologic sequestration would need to be included.
- The uncertainty of environmental legislation.
- Lack of a long-term energy strategy for the country.

Based on the FEED study, Basin Electric analyzed the technical, operational, regulatory and financial risks for installing carbon capture technology at a conventional coal-based power plant. "It's imperative that a revenue stream, such as EOR, be available to make a project like this viable," Harper says. "While a strong potential exists for CO_2 sales for EOR, they have not yet developed and there's no certainty they'll develop in the near future."

The FEED study was conducted in conjunction with HTC Purenergy, Regina, Saskatchewan, Canada, and Doosan Power Systems, Crawley, United Kingdom. HTC has designed a proprietary CO_2 capture technology, supported by Doosan, that is designed to capture 90 percent of the incoming CO_2 from the exhaust gases produced by one of the Antelope Valley Station units.

The cost of the FEED study was $6.2 million; about half ($2.7 million) of the study was funded by a grant from the North Dakota Industrial Commission. The remainder was funded by Basin Electric.



"With the information in hand, we know what the impacts of the costs and the operational challenges of a project like this will have on our consumers and how they would be affected if a full-scale implementation of this capture technology were to be employed.

"Basin Electric isn't willing to place the burden of developing CO_2 capture technology on its rural electric members," Harper says.

Even though the project is on hold for now, Harper says Basin Electric will continue to work with the Energy and Environmental Research Center in Grand Forks and the Plains CO_2 Reduction Partnership to research CO_2 storage technology.

Bacteria and coal gasification

For more than 25 years, an "energy park" near the Laramie River Station, Wheatland, WY, hasn't had a permanent tenant. By the end of 2011, that may change. At a recent board meeting, Basin Electric's directors granted permission to Ciris Energy, Centennial, CO, to build a demonstration project there.

According to Doug Rothe, mechanical/performance consulting engineer for Basin Electric, Ciris Energy plans to build a project to demonstrate coal gasification with a process similar to what naturally occurs to produce coal bed methane. They intend to use a chemical to dissolve the coal, and then bacteria to digest it and convert it into methane gas.

Rothe says Ciris is funding and building the project. "We're simply facilitating the demonstration plant by providing a location, coal supply and water supply, all at an appropriate cost to Ciris," he says. "They'll use up to five tons of coal a day, and will likely flare any gas produced. They have tested the technology at a lab in Colorado."

The energy park, owned by the Missouri Basin Power Project, features a warm water pipeline and vault, owned by the town of Wheatland, WY, where warmed water from the plant's cooling towers can be stored and used by a tenant if needed. The concept of an energy park is to use a byproduct from the power plant – in this case, warm water – for other purposes such as the Ciris project.

Rothe says the Ciris project is intended to be an inexpensive way to convert coal to a fuel with a lower carbon footprint. "By working with Ciris, we'll learn about the technology and will have an opportunity to work with them on a commercial venture in the future should the technology prove out."

Wind-to-Hydrogen project wraps up

The project's goal: Find a way to store wind energy through dynamic scheduling. Large amounts of electricity can't feasibly be stored in batteries because the batteries would be too big and expensive.

The Wind-to-Hydrogen project, located one mile south of Minot, ND, at North Dakota State University's Central Research Extension Center, was a demonstration project in partnership with the U.S. Department of Energy to explore storing energy from wind projects in the form of hydrogen. The project used an electrolyzer to produce hydrogen. An electrolyzer separates the hydrogen and oxygen contained in water. Software and controls were developed to select any of Basin Electric's wind projects and then dynamically schedule the electrolyzer's production of hydrogen in direct proportion of the output from that wind project. The hydrogen was stored and used as transportation fuel in three pickups adapted to use hydrogen.

Randy Bush, formerly Basin Electric's distributed resource coordinator,* says a major goal was to create the program and protocols to dynamically schedule electricity from the wind turbines to the electrolyzer. He says the project's goals have been accomplished and research completed. The DOE accepted the project's final report in June 2009.

"Dynamic scheduling allowed the electrolyzer to draw electric energy from the grid as it was produced by the wind turbines. The electrolyzer was being ramped up and down as dictated by the wind generation output," Bush says.

The DOE awarded Basin Electric just under $1.5 million in grants for the project.

**Randy Bush is now a buyer for Basin Electric.*

SUBMITTED BY REPRESENTATIVE KEVIN CRAMER

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Congress of the United States
House of Representatives

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ENERGY AND COMMERCE

SUBCOMMITTEE ON
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SUBCOMMITTEE ON
COMMERCE, MANUFACTURING AND
TRADE

SUBCOMMITTEE ON
ENVIRONMENT AND THE ECONOMY

October 23, 2013

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Dear Administrator McCarthy:

We are troubled by the EPA's announcement on September 30, 2013 entitled "EPA to Hold Public Listening Sessions on Reducing Carbon Pollution from Existing Power Plants." While hosting eleven public listening sessions held across the country in order to solicit feedback from the public is important, your plan leaves out those most impacted by the regulation by seeking input **only** in major urban areas.

While the proposed regulations on new and existing power plants may not be burdensome to cities such as Boston, San Francisco, Washington, D.C., or New York City, it will have significant impacts on businesses and families in rural areas. Already, one-fifth of our nation's coal plants, 204 facilities across 25 states, closed between 2009 and 2012. These closed and existing plants are **not** located in areas you are holding these listening sessions. In all fairness, residents and businesses in rural areas deserve to be heard just as much.

The EPA must hear from Americans on Main Street in rural America **not** downtown San Francisco or Washington, D.C. If the EPA really wants to learn the impact this regulation will have on mayors, store clerks, senior citizens, blue-collar Americans and others, you must hold these sessions in locations that produce coal and coal-fired electricity. We highly recommend that you and your colleagues take a step out of the Beltway and visit the places that make America great; the places your regulations continue to devastate by shuttering plants and killing jobs. These people need your help and want their views to be heard. Please add rural American communities in which coal and gas are a part of their economies to your locations for listening sessions.

Thank you for your attention to this matter, and we look forward to your thoughts.

Sincerely,

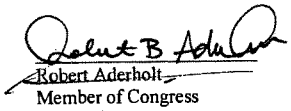
David B. McKinley, P.E.
Member of Congress

Shelley Moore Capito
Member of Congress

Congress of the United States
Washington, DC 20515


Lynn Westmoreland
Member of Congress


Marsha Blackburn
Member of Congress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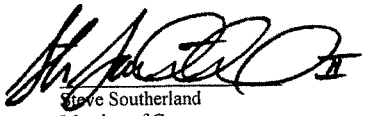
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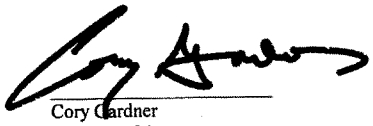
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Member of Congress


Rodney Davis
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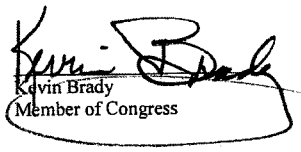
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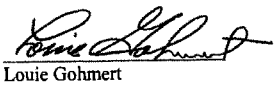
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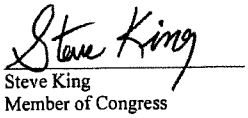
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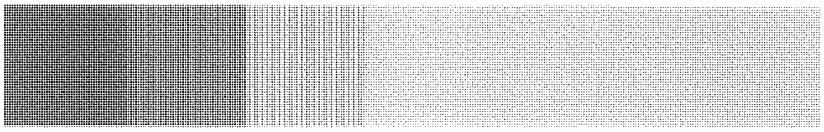
SUBMITTED BY THE HONORABLE CHARLES MCCONNELL

September 2011

Potential Impacts of EPA Air, Coal Combustion Residuals, and Cooling Water Regulations



Prepared for:

American Coalition for Clean Coal Electricity

Prepared by:

NERA

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Contents

Executive Summary

This report evaluates the potential energy and economic impacts of four major environmental regulations that would affect the electricity sector. The regulations include two major air emission policies—the Cross-State Air Pollution Rule (CSAPR) and regulation of mercury and other hazardous emissions (Utility MACT)—as well as policies to regulate coal combustion residuals (CCR) under the Resource Conservation and Recovery Act and to regulate cooling water intake under Section 316(b) of the Clean Water Act. We focus on the potential near- and medium-term (2012-2020) implications for electricity and other energy prices and for national economic impacts. This methodology is designed to complement analyses of individual regulations, including assessments of their social benefits and costs.

A. Background

Environmental legislation provides the mandate for the development of individual regulations. The U.S. Environmental Protection Agency (EPA)—sometimes in conjunction with state environmental agencies—develops regulations to implement these Congressional directives. EPA typically proposes a single regulation and provides information on its individual social costs and benefits (and other impacts), with previously-promulgated regulations being included in the baseline and the implications of other potential future regulations not considered.

In addition to analyses of individual regulations and their social costs and benefits, however, there are other impacts of environmental regulations that are of interest to policy makers but that are not necessarily included in regulatory analyses. Interest in "green jobs" has provided one additional focus. Some studies have noted that environmental mandates will increase employment in pollution control and clean technology sectors (see, e.g., Ceres 2010). Other commentators, however, have noted that these results ignore the jobs lost in the rest of the economy due to other impacts of the regulations, including increased electricity and other energy prices (see, e.g., Montgomery 2011).

There also has been a concern that focusing on individual regulations neglects the cumulative effects of multiple environmental regulations. Since these initiatives tend to increase future costs for coal-fired power plants, many studies have assessed the potential for regulations to lead to increases in coal unit retirements—since owners of some coal-fired power plants will choose to retire their units rather than install expensive control equipment—and some of these studies have assessed the possibility of impacts on electric system reliability.[1] Projections for a continuation of the recent trend of low electricity prices—driven by low natural gas prices—tend to increase pressures for coal unit retirements. Coal unit retirements and compliance costs for units that do not retire in turn can lead to increases in electricity and natural gas prices and decreases in coal prices. These changes in energy market conditions can lead to changes in output and employment.

[1] See Bipartisan Policy Center (2011), Brattle Group (2010), Charles River Associates (2010b), Edison Electric Institute (2011), ICF International (2010), M.J. Bradley & Associates and Analysis Group (2011), and North American Electric Reliability Corporation (2010).

B. Objectives and Methodology of This Study

This study develops a set of models to evaluate the potential effects of various environmental regulations on energy markets and economic activity. This methodology thus complements those that have been developed to estimate the costs and benefits—and other impacts—of individual regulations.

Specifically, this report develops estimates of the effects over the period from 2012 to 2020 of the four environmental regulations—the two air emission regulations as well as CCR and Section 316(b)—in three major areas:

1. *Coal unit retirements.* These are estimates of the effects of potential costs on future coal unit retirements. As noted, we develop a probability distribution based upon the range of uncertain parameters.

2. *Electricity and other energy market impacts.* These impacts include the potential effects on energy markets—including coal, natural gas, and electricity—as well as on overall compliance costs.

3. *Economic impacts.* These effects include impacts on the U.S. economy, including employment, gross domestic product (GDP), and disposable personal income (i.e., personal income after taxes).

The modeling framework begins with a set of detailed estimates of the likely compliance technologies—and their costs—associated with the individual regulations. These assessments are based upon the requirements of the individual regulations, including taking into account the potential flexibility provided under CSAPR.[2] For the CCR and Section 316(b) regulations, we use EPA estimates of compliance costs for the various affected units. The result is a set of estimates of the potential technologies and costs to individual electricity generating units under the four policies.

The next task is to estimate the effects of these projected costs on future retirements of coal-fired power plants. The retirement model we develop is a Monte Carlo uncertainty model designed to predict potential economic retirements based upon comparisons of the future costs of the coal-fired unit in comparison to the costs of the likely new generation that would be added in the future. The model incorporates uncertainties in key parameters affecting this comparison, including control costs and electricity and fuel (notably natural gas) prices; the model also takes account of the feedback effects of coal unit retirements on electricity and fuel prices.

The estimated coal unit retirements and the estimated compliance costs for non-retiring units are then input to the U.S. Department of Energy's National Energy Model System (NEMS) model, a well-established modeling framework used by the Energy Information Administration (EIA) to evaluate energy and environmental policies. To develop estimates of changes in employment and

[2] The implications of the emissions trading provisions of CSAPR for technology choices at individual units are developed through an initial run of the NEMS model (a model that is described in the text).

other economic impacts, the NEMS results are input to the Policy Insight Plus model developed by Regional Economic Models, Inc. (REMI PI+), a model used extensively by numerous government agencies and private groups to assess the economic impacts of public and private policies.

Although we have attempted to develop comprehensive assessments, the results should be viewed as subject to considerable uncertainties beyond those incorporated in the analyses. Projected coal unit retirements, for example, do not include the effects of other potential regulatory requirements—notably those related to greenhouse gases—and the impacts do not include potential effects of coal unit retirements on (or constraints related to) electricity system reliability. These omitted factors could lead to additional impacts beyond those estimated in this study.

C. Results of This Study

1. Coal Unit Retirements

The potential costs of the four policies are estimated to lead to 39 gigawatts (GW) of prematurely retired capacity by 2015 among the current coal-fired power plants. This estimate represents additional retirements above those in the reference case (i.e., retirements predicted without the four regulations in place) and accounts for about 12 percent of the 2010 U.S. coal-fired electricity generating capacity.[3] As noted, this estimate does not include the potential effects of other potential requirements—notably potential greenhouse gas emission regulations—or concerns related to detailed electricity system reliability.

2. Energy Market Effects

As noted, the energy market impacts of the various regulations were estimated using the National Energy Modeling System (NEMS) based on estimates of the coal units that retire and the compliance costs for units that do not retire. The NEMS output includes estimates of overall compliance costs for the electric sector as well as detailed impacts on energy markets.

Table ES-1 summarizes the potential costs for the electricity sector based on the level of coal retirements predicted in the retirement model. These costs include compliance costs for coal units that do not retire, capital costs for new capacity that would replace retiring coal units, and changes in fuel costs. Costs are projected to be approximately $21 billion (in 2010$) per year over the period from 2012 to 2020. The costs represent a total of $127 billion (present value in 2010$ as of January 1, 2011) over the period from 2012 to 2020. Capital costs for environmental controls and replacement capacity are about $104 billion.[4]

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[3] This level of retirements is estimated in the retirement model and is not influenced by utility retirement announcements.

[4] Capital costs exceed the total for environmental controls and replacement capacity because of net reductions in operating and maintenance costs.

Table ES-1. Electricity Sector Costs, 2012-2020 (billion 2010$)

	Annual Avg	PV
Environmental Controls	$15	$89
Replacement Capacity	$2	$11
Fuel	$5	$28
Total	$21	$127

Note: Compliance costs from 2012 through 2020 are discounted to January 1, 2011 using a real annual discount rate of 7 percent.
Annual average costs are based on the present values and discounting.
The cost of environmental controls includes net cost savings for operating and maintenance (O&M) expenses.
Source: NERA calculations as explained in text

The retirement of coal units and construction of replacement capacity affect electricity sector fuel consumption, fuel prices, and electricity prices. Table ES-2 summarizes the average potential energy market effects of the four regulations from 2012 to 2020. Appendix C provides information on the annual effects for 2012-2020, with effects that are both higher and lower than these average values.

Table ES-2. Average Annual Energy Market Impacts, 2012-2020

	Coal Retirements	Coal-Fired Generation	Coal Price at Minemouth	Gas-Fired Generation	Gas Price at Henry Hub	Avg Retail Elec Price
	(GW)	(million MWh)	(2010$/ton)	(million MWh)	(2010$/MMBtu)	(2010$/MWh)
	Average of 2012-2020 Projections					
Reference	3.1	1,911	$33.54	639	$4.48	$86.87
CSAPR+MACT+CCR+316(b)	42.2	1,699	$31.61	765	$4.95	$92.52
	Change from Average of 2012-2020 Reference Projections					
CSAPR+MACT+CCR+316(b)	+39.1	-212	-$1.93	+126	+$0.48	+$5.65
	% Change from Average of 2012-2020 Reference Projections					
CSAPR+MACT+CCR+316(b)	+1241%	-11.1%	-5.7%	+19.7%	+10.7%	+6.5%

Note: Coal retirements are cumulative from 2010 through 2020.
Source: NERA calculations as explained in text

Coal-fired generation is projected to decrease by an average of 11.1 percent over the period from 2012 to 2020. The reduction in coal demand is projected to decrease coal prices by 5.7 percent on average. In contrast, the regulations are predicted to increase natural gas-fired generation by 19.7 percent on average over the period and increase Henry Hub natural gas prices by 10.7 percent on average. The increases in natural gas prices would lead to an estimated average increase in costs of about $8 billion per year for residential, commercial and industrial natural gas consumers, which translates into an increase of $52 billion over the 2012-2020 period (present value in 2010$ as of 2011 discounted at 7 percent). Average U.S. retail electricity prices are projected to increase by an average of 6.5 percent over the period. Information on the annual energy market effects from 2012 to 2020 is provided in Appendix C.

3. Economic Impacts

The potential economic impacts of the four policies were estimated using the REMI PI+ model. Table ES-3 summarizes the potential economic impacts. The table shows both the average annual changes over the period from 2012 to 2020 as well as the cumulative effects over the same time period. These net figures take into account jobs that would be created in some sectors as a result of spending on pollution controls (i.e., "green jobs") as well as jobs lost due to higher electricity prices and other negative impacts.

Table ES-3. U.S. Economic Impacts, 2012-2020

	Annual Average	Cumulative
Employment	-183,000 jobs	-1.65 million job-years
Gross Domestic Product	-$29 billion	-$190 billion
Disposable Personal Income	-$34 billion	-$222 billion
Disposable Personal Income per Household	-$270	-$1,750

Note: All dollar values are in 2010$.
The cumulative employment impact is an undiscounted sum from 2012 to 2020; the cumulative GDP and disposable personal income impacts are present values as of January 1, 2011 using a real annual discount rate of 7 percent.
Disposable personal income impacts per capita from REMI were converted to disposable personal income impacts per household based on a current average U.S. household size of 2.58 people (Census 2011).
Source: NERA calculations as explained in text

Over the period from 2012 to 2020, about 183,000 jobs per year are predicted to be lost on net due to the effects of the four regulations. The cumulative effects mean that over the period from 2012 to 2020, about 1.65 million job-years of employment would be lost. As noted, these net employment losses reflect net gains in some sectors and net losses in others. Of the 70 sectors in the REMI PI+ model, sectors that would gain jobs account for about 55,000 added jobs per year on average, and sectors that would lose jobs account for about 238,000 fewer jobs per year on average. On a cumulative basis over the period from 2012 to 2020, the sectors that would gain jobs represent about 499,000 job-years, and the sectors that would lose jobs represent about 2,149,000 job-years.

Table ES-3 also shows the potential near- to medium-term impacts on GDP and disposable personal income. U.S. GDP would be reduced by $29 billion each year on average over the period, with a cumulative loss from 2012 to 2020 of $190 billion (2010$). U.S. disposable personal income would be reduced by $34 billion each year on average over the period, with a cumulative loss from 2012 to 2020 of $222 billion (2010$). The average annual loss in disposable personal income per household is $270, with a cumulative present value loss of about $1,750 (2010$) over the period from 2012 to 2020. Annual economic impacts from 2012 to 2020 are provided in Appendix D.

I. Introduction

This report examines various effects of environmental regulations being developed by the U.S. Environmental Protection Agency (EPA) that affect the electric utility sector. We focus on the cumulative effects of four major environmental regulations on the energy sector and on economic activity, including employment and other measures.

A. Background

EPA has proposed major air emissions and other regulations in recent years. The two air regulations that are likely to have the greatest effect on the electric utility sector are the Cross-State Air Pollution Rule (CSAPR) and the regulations of mercury and other hazardous air emissions under Section 112 of the Clean Air Act (Utility MACT). These two regulations are at different stages of development. CSAPR was promulgated as a final rule in August 2011 (although there are some outstanding issues that EPA continues to review). Utility MACT was proposed in May 2011 and is expected to be made final in November 2011.

In addition to these two major air emissions rules, electric utility plants face other potential environmental regulatory requirements that would require additional investments. EPA recently has proposed a regulation under Section 316(b) of the Clean Water Act that regulates cooling water intake structures from electric power plants (and other facilities) in order to reduce losses to fish and other aquatic organisms. In addition, EPA has proposed regulations under the Resource Conservation and Recovery Act that would change how some plants manage their solid waste streams (the ashes from the burned coal and the sludge from their flue gas desulfurization (FGD) systems). Our assessments focus on the two air emission regulations and the 316(b) and CCR regulations; electricity generating units face environmental costs for other potential regulatory requirements—notably including those related to greenhouse gases—that are not included in our estimated impacts.

The EPA has developed assessments of the potential impacts of these various regulations and proposed regulations in separate regulatory impact analyses (RIAs). These RIAs provide important information on the potential social costs and social benefits of the proposed regulations as well as their potential effects on the energy sector. The public comments provide other information on the potential effects of the individual rules. Information on individual regulations, however, is limited because it does not measure the cumulative effects of many potential regulatory requirements either on individual power plants or on energy markets.

In the face of the limited information provided by evaluating individual regulations, various studies have evaluated the combined effects of various EPA regulations. Most of the studies have evaluated impacts on potential retirements of coal-fired units and some studies have estimated potential implications for electricity system reliability.[5] These studies differ substantially in the

[5] See Bipartisan Policy Center (2011), Brattle Group (2010), Charles River Associates (2010b), Edison Electric Institute (2011), ICF International (2010), M.J. Bradley & Associates and Analysis Group (2011), and North American Electric Reliability Corporation (2010). Note that the ability of these national studies to evaluate

environmental regulations they evaluate and in the nature of their evaluations. The prospect of substantial expenditures for pollution controls results in additional projected coal unit retirements, as every prior study has found.

The potential economic impacts of these rules—including their potential effects on employment and other measures of economic activity—have been less studied than their impacts on potential coal unit retirements, although some studies have considered potential economic impacts of some aspects of the regulations. For example, Ceres (2010) has developed estimates of the potential positive effects of the regulations on employment related to expenditures for emission controls. As various commentators have noted, however, this study did not provide information on the potential negative effects of higher electricity prices and other means of financing the added costs (see, e.g., Montgomery 2011). To our knowledge, no other study has estimated the cumulative economic impacts that include both the positive and negative effects of these four major regulations.

B. Objectives of This Report

The overall objective of this report is to provide estimates of the cumulative energy and economic effects of these four environmental regulations over the period from 2012 to 2020. That is, we consider the potential effects of these regulations on energy markets as well as on employment and other measures of economic activity. We have developed a modeling framework to estimate these various effects. We emphasize, however, that we have not developed estimates of the potential social benefits and social costs of these regulations and do not evaluate whether the individual regulations—or possible regulatory alternatives—would be desirable from a societal perspective.

In particular, the assessments presented in this study include the following three major types of effects.

1. *Coal unit retirements.* We consider the potential effects of regulatory requirements on coal unit retirement decisions based upon various key uncertainties, including the level of future natural gas and coal prices as well as the level of compliance costs. We use the results from this modeling framework to develop potential ranges of total U.S. coal unit retirements.

2. *Energy market effects.* We use information on predicted coal unit retirements as well as information on control costs for units that are not expected to retire to develop estimates of the potential effects of the policies on electricity and other energy markets. The results include estimates of the total compliance costs for the electricity sector due to the regulations, including control costs (capital as well as operation and maintenance), changes in fuel costs, and the costs of additional capacity added.

3. *Economic impacts.* The economic impacts of the regulations—including effects on employment, gross domestic product (GDP), and disposable personal income (i.e., personal

impacts on electricity system reliability is limited, since reliability impacts are likely to be sensitive to various system details (e.g., local transmission and voltage constraints) that are not included in the studies.

income after taxes)—are estimated by using the energy impacts in an economic impact model.

There are substantial uncertainties involved in developing these estimates. As discussed below, the model we use to develop estimates of coal unit retirements incorporates key uncertainties. It is important to emphasize, however, that other uncertainties are not modeled—including the possibility that coal and other units will face potential regulations related to greenhouse gases—and thus the projections presented in this report should be viewed as estimates of the likely impacts of only the four policies evaluated.

C. Outline of This Report

The remainder of this report is organized as follows. Chapter II provides an overview of the methodologies that are used and the policies that are evaluated in the study. Chapter III presents the results of the analyses. The appendices provide details on the models, compliance assumptions, methodologies, and results.

II. Overview of Methodologies and Policies

This chapter provides summary information on the methodologies used to estimate the potential economic impacts of the four policies. We also provide overviews of the four environmental policies that are modeled. Additional details of the models, policies, and data are provided in the appendices.

A. Modeling Framework

The methodology used in this study is based upon a set of linked models designed to assess the energy and economic impacts of environmental regulations affecting the electric utility sector. The empirical estimates of policy impacts are developed by comparing impacts under a baseline case (i.e., a case without the policies in place) and impacts under the policy case.

1. Overview of Modeling Framework

The modeling framework consists of three principal elements:

1. *Retirement Model*, which estimates whether coal units would be expected to retire based upon comparisons of the expected value of the future costs for the coal unit—including the likely potential costs of additional environmental controls—and the expected costs of an equivalent new natural gas combined cycle unit;

2. *National Energy Modeling System* (NEMS) model developed by the U.S. Energy Information Administration (EIA), which we use to assess the likely effects of compliance costs and coal unit retirements on the energy markets; and

3. *Policy Insight Plus model developed by Regional Economic Models, Inc. (REMI PI+)*, which we use to develop estimates of the economic impacts of energy market effects.

The following sections provide summaries of these elements.

2. Coal Unit Retirement Model

Power companies face the choice of retrofitting existing coal units to meet regulations or retiring them if the future costs do not justify continued operation in light of the likely costs of alternative sources to meet future electricity demand. We developed a detailed model to evaluate whether existing coal units in the United States would be expected to retire taking into account the potential costs of retrofit (and other future costs) as well as uncertainties in energy prices and other factors.

The retirement model is designed to mirror the decision by power companies on whether to retrofit coal-fired units with environmental controls or retire them and replace them with new capacity. A Monte Carlo formulation takes into account major uncertainties involved in this decision.

The model begins with estimates of the potential additional costs related to environmental policies. The potential future costs for coal units are based upon EIA data on unit characteristics (including capacity, capacity factor, heat rate, O&M costs, coal type, and current environmental controls) and on EPA information on the potential costs of the various controls. The potential technologies and costs for each coal-fired unit also reflect the flexibility that CSAPR provides—due to the potential for emissions trading—as well as the fuel and electricity prices based upon a similar level of retirements.[6] The model thus takes account of the feedback effects of coal unit retirements on electricity and fuel prices.

The model uses statistical techniques and EPA data to simulate hourly electricity prices in each region—as a function of natural gas prices, time of day, season, peak/off-peak, and other factors—and generation decisions by coal units and potential replacement capacity, with generation a function of price and marginal cost. Uncertain parameters include the costs of controls, fuel prices and electricity prices, and the costs of the likely replacement alternative (a new natural gas combined cycle unit), with interactions among the uncertain parameters included in the Monte Carlo formulation.

Future coal unit costs are compared with the future costs of a new natural gas combined cycle unit by calculating the difference between the cost of the coal unit and the cost of the natural gas alternative in each of the 100 Monte Carlo draws. The unit is presumed to retire if the expected value of the cost difference is positive, i.e., on expectation, the coal unit would have greater future costs than a new natural gas combined cycle unit. Existing coal unit remaining lifetimes in these calculations are assumed to range between 10 and 20 years, depending upon unit age in 2015, to reflect the likelihood that owners of older units will have a shorter time horizon for recovering the cost of additional controls. The formulation accounts for the costs of using system energy during hours when coal units and the potential replacement capacity would not run.

3. NEMS Model

The National Energy Modeling System (NEMS) is a computer-based, energy-economy modeling system of the U.S. through 2030. NEMS projects the production, imports, conversion, consumption, and prices of energy, subject to assumptions on macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria, cost and performance characteristics of energy technologies, and demographics. NEMS was designed and implemented by the Energy Information Administration (EIA) of the U.S. Department of Energy (DOE).

4. Regional Economic Models, Inc. Policy Insight Plus Model

The Regional Economic Models, Inc. (REMI) Policy Insight Plus (PI+) model produces estimates of the changes in employment, GDP, disposable personal income, and other macroeconomic variables due to changes in supply, demand, prices, and other types of inputs. Each version of the REMI PI+ model is custom-built for the regions of interest, which can range

[6] We develop the implications of emissions trading flexibility provided by CSAPR by running the NEMS model with the relevant caps. The technologies identified in this run for each unit are used in the retirement model.

from counties to entire countries. The REMI PI+ model incorporates detailed and up-to-date macroeconomic data from the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, the U.S. Census Bureau, and other public sources. The REMI PI+ model is widely used by federal, state, and local agencies, as well as analysts in the private sector and academia, to estimate the effects of regulations, investments, closures, and other scenarios.

B. Overview of Policies Modeled

This section summarizes the four policies evaluated in this report, including the two air emission regulations (CSAPR and Utility MACT) as well as Section 316(b) and CCR. Appendix A provides details on how the reference case and the four policies are modeled, including information on the control cost assumptions that are used.

1. Reference Case

The version of NEMS used for the model represents current legislation and environmental regulations as of January 31, 2011. The policies included in the reference case include state requirements for reduction of mercury emissions but not the Clean Air Mercury Rule, which was vacated and remanded by the D.C. Circuit Court of the U.S. Court of Appeals on February 8, 2008. The reference case also includes the temporary reinstatement of the SO_2 and NOx cap-and-trade programs included in the Clean Air Interstate Rule (CAIR) as a result of the ruling issued by the United States Court of Appeals for the District of Columbia on December 23, 2008.[7] CAIR is included in the reference case through 2011. From 2012 onward, SO_2 and NOx caps revert to pre-CAIR levels.

Proposed federal and state legislation, regulations, or standards—and sections of legislation that have been enacted but require funds or implementing regulations that have not been provided or specified—are not reflected in the reference case. The excluded policies include the four policies evaluated in our study.[8]

2. Cross-State Air Pollution Rule

EPA promulgated CSAPR in August 2011, following a draft rule (Clean Air Transport Rule, or CATR) proposed in August 2010 as a replacement to CAIR. CSAPR requires 27 states to reduce power plant emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) from power plants in Eastern states in an effort to improve ozone and fine particulate air quality in other downwind states.[9] Under CSAPR, EPA set new limits on SO_2 and NO_x emissions for each state beginning in 2012. The limits tighten in some states in 2014.

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[7] EPA finalized CAIR in 2005 but the rule was remanded to EPA by the D.C. Circuit Court of Appeals in 2008. The court decision required EPA to develop a different regulatory approach but to implement CAIR in the meantime.

[8] Note that we include CSAPR in our assessments although EPA finalized CSAPR in August 2011 (EPA 2011a).

[9] In a separate but related regulatory action, EPA also issued a supplemental notice of proposed rulemaking to require six states to make summertime NOx reductions under the CSAPR ozone-season program. Finalizing this

3. Utility MACT

EPA proposed the Utility MACT rule in May 2011 to reduce emissions of mercury and other hazardous air pollutants (including other hazardous metals and acid gases) from coal- and oil-fired power plants across the country. The rule would set emission rate standards for different types of coal- and oil-fired units based on maximum achievable control technology. The emission rate standards would apply to mercury, other non-mercury metallic hazardous air pollutants (using particulate matter as a proxy), and acid gases (using hydrogen chloride as a proxy). Covered power plants would have up to three years to comply with the rule, but permitting authorities could grant one-year extensions to power plants if they required additional time.

4. Coal Combustion Residuals

EPA issued a proposed rule on June 21, 2010 related to the regulation of coal combustion residuals (also referred to as coal combustion waste) under the Resource Conservation and Recovery Act (RCRA). The regulations apply to the management of coal combustion residuals generated by steam electric power plants (i.e., electric utilities and independent power producers) that are disposed of in landfills and surface impoundments.

EPA co-proposed two approaches to the regulation of coal combustion waste. The first would regulate residuals under Subtitle C of RCRA as a "special waste." The second would regulate residuals under Subtitle D as a non-hazardous waste. Our assessments are based on the potential costs to individual units of regulating coal combustion residuals under Subtitle D.

5. Clean Water Act Section 316(b)

On April 20, 2011, EPA proposed cooling water intake requirements for existing power plants and other industrial facilities under Section 316(b) of the Clean Water Act. These facilities withdraw water and in the process, fish and other aquatic organisms are lost if they become trapped against intake screens ("impingement") or pulled into the cooling system ("entrainment"). Various technologies reduce impingement and entrainment losses, including the retrofit of plants with cooling towers to provide closed-cycle cooling.

EPA evaluated four alternatives for setting Section 316(b) standards, with Option 1 identified as its preferred option. Option 1 would require that existing plants withdrawing water above a proposed 2 million gallon per day threshold reduce the impingement mortality by meeting various national standards (EPA 2011b, pp. 22203-22204). In contrast, entrainment controls would be set on the basis of site-specific requirements. Under EPA's proposal, permit writers will be required to consider converting the condenser cooling system from once-through cooling to closed-cycle cooling through the use of cooling towers, which reduces net flow and thus entrainment losses (albeit at substantial cost and often undesirable environmental side-effects). EPA estimated the cost of installing cooling towers under Option 1 at the 46 fossil units with the

supplemental program would bring the total number of covered states under the CSAPR to 28. EPA reports that it is proposing to finalize this proposal by late fall 2011.

largest cooling water withdrawals from tidal waters. Our assessments are based on the potential costs to individual units of the Option 1 alternative.

III. Study Results

This chapter summarizes the study results for our analyses of the cumulative energy and economic impacts of the four environmental policies. The results are grouped into three categories: (1) coal unit retirements; (2) energy market effects; and (3) economic impacts. Additional details are provided in the appendices.

A. Coal Unit Retirements

1. National Results

The potential costs of the four policies are estimated to lead to 39 gigawatts (GW) of prematurely retired capacity among the current coal-fired power plants. This figure represents additional retirements above those in the reference case (i.e., retirements predicted without the four regulations in place) and accounts for about 12 percent of the 2010 U.S. coal-fired electricity generating capacity. As noted, this estimate does not include the potential effects of other potential requirements—notably potential greenhouse gas emission regulations—or concerns related to detailed electricity system reliability.

We developed an assessment of the potential range of possible retirements using the information from the 100 individual draws from the retirement model. We calculated the retirements in each of the draws as a sensitivity analysis, assuming that a unit would retire if its future costs were greater that the future costs of the natural gas unit in those circumstances. The range of retirements was from 17 GW to 79 GW in these 100 cases. This range is roughly consistent with sensitivity results from other studies, although the other studies do not use the same assumptions and methodology.[10]

2. Uncertainties Regarding Estimated Retirements

The range of potential retirements provides an indication of the substantial uncertainty surrounding potential retirements due to uncertainties in future natural gas prices, control costs and other factors influencing individual retirement decisions. There are, however, some factors that are not included in the retirement model. The retirement model does not account for the possibility that adjustments could occur if the local effects of retirements were severe (e.g., likely to impair electricity system reliability). These adjustments would tend to reduce the actual level of retirements below those predicted by our model, which is based upon economic calculations, although the potential impacts on electricity prices could be greater than estimated assuming units are allowed to retire.

In addition, the model does not factor into the calculation of expected future costs the potential costs and other impacts associated with greenhouse gas regulations. Even without the prospect of

[10] EIA, for example, reports a range of retirements for the two air emissions regulations from 4.7 GW to 63.8 GW (net of reference case retirements) depending upon the level of future natural gas prices as well as the likely time horizon for amortizing compliance capital costs (EIA 2011, p. 50).

specific regulatory requirements, owners of coal-fired power plants are likely to reflect the prospect of potential greenhouse gas regulations in their decisions on whether to incur large compliance expenditures or retire their units. Our estimates do not take into account these effects, which would lead to greater coal unit retirements.

3. Regional Results

The expected coal unit retirements differ substantially among electricity regions. Table 1 shows the potential coal unit retirements by North American Electric Reliability Corporation (NERC) region.[11] The table also shows the percentage of 2010 coal capacity in each region that is predicted to retire by 2015 and each region's share of total U.S. retirements. Note that most retirements are in the Mid-Atlantic and Great Lakes and Southeast regions. These results are consistent with the results of other studies (e.g., Brattle Group 2010).

Table 1. Regional Retirement Estimates

		2010 Coal Capacity (GW)	Retirements (GW)	% of Regional 2010 Coal Cap	% of Total Retirements
	U.S. Total	318.1	39.1	12%	100%
NERC Regions					
NPCC	Northeast	5.7	1.3	22%	3%
RFC	Mid-Atlantic and Great Lakes	107.8	14.5	13%	37%
SERC	Southeast	98.5	18.0	18%	46%
FRCC	Florida	10.3	0.1	1%	0%
MRO	Upper Midwest	28.8	1.9	6%	5%
SPP	Oklahoma and Kansas	19.0	1.6	9%	4%
ERCOT	Texas	18.2	0.6	3%	1%
WECC	West	29.8	1.2	4%	3%

Source: NERA calculations as explained in text

B. Electricity and Energy Market Impacts

As described in the previous section, we used NEMS to estimate net changes in coal-fired generation, natural gas-fired generation, fuel prices, and electricity prices as a result of coal unit retirements and environmental controls due to the four policies.

1. National Results

Table 2 summarizes the potential costs for the electricity sector based on the level of coal retirements predicted in the retirement model. These costs include compliance costs for coal units that do not retire, capital costs for new capacity that would replace retiring coal units, and changes in fuel costs. Costs are projected to be approximately $21 billion (in 2010$) per year over the period from 2012 to 2020. The costs represent a total of $127 billion (present value in

[11] NEMS provides information for 22 regions; we have aggregated the results into the eight major NERC regions.

2010$ as of January 1, 2011) over the period from 2012 to 2020. Capital costs for environmental controls and replacement capacity are approximately $104 billion.[12]

Table 2. Electricity Sector Costs, 2012-2020 (billion 2010$)

	Annual Avg	PV
Environmental Controls	$15	$89
Replacement Capacity	$2	$11
Fuel	$5	$28
Total	$21	$127

Note: Compliance costs from 2012 through 2020 are discounted to January 1, 2011 using a real annual discount rate of 7 percent.
Annual average costs are based on the present values and discounting.
The cost of environmental controls includes cost savings for operating and maintenance (O&M) expenses.
Source: NERA calculations as explained in text

Table 3 summarizes the average effects of the four policies at the national level over the period from 2012 to 2020. (Detailed annual impacts are provided in Appendix C, with effects that are both higher and lower than these average values.)

Table 3. Average Annual Energy Market Impacts, 2012-2020

	Coal Retirements	Coal-Fired Generation	Coal Price at Minemouth	Gas-Fired Generation	Gas Price at Henry Hub	Avg Retail Elec Price
	(GW)	(million MWh)	(2010$/ton)	(million MWh)	(2010$/MMBtu)	(2010$/MWh)
	Average of 2012-2020 Projections					
Reference	3.1	1,911	$33.54	639	$4.48	$86.87
CSAPR+MACT+CCR+316(b)	42.2	1,699	$31.61	765	$4.95	$92.52
	Change from Average of 2012-2020 Reference Projections					
CSAPR+MACT+CCR+316(b)	+39.1	-212	-$1.93	+126	+$0.48	+$5.65
	% Change from Average of 2012-2020 Reference Projections					
CSAPR+MACT+CCR+316(b)	+1241%	-11.1%	-5.7%	+19.7%	+10.7%	+6.5%

Note: Coal retirements are cumulative from 2010 through 2020.
Source: NERA calculations as explained in text

The potential impacts of the four policies on energy markets are substantial.

- Coal-fired generation is predicted to decrease substantially, by an average of 11.1 percent relative to average reference case levels over the 2012-2020 period.
- In contrast, natural gas-fired generation is predicted to increase substantially, by an average of 19.7 percent relative to average reference case levels over the same period.

[12] Capital costs exceed the total for environmental controls and replacement capacity because of net reductions in operating and maintenance costs.

- Average coal prices are predicted to decline, reflecting the reduction in coal-fired generation. Coal prices decline an average of 5.7 percent relative to average reference case levels over the same period.

- Average natural gas prices are predicted to increase, reflecting the increased demand for gas-fired generation. Henry Hub natural gas prices increase an average of 10.7 percent relative to average reference case levels over the 2012-2020 period. These prices increases would increase costs by about $8 billion per year for residential, commercial, and industrial customers (and a total of about $52 billion as a present value as of January 1, 2011 over the period).

- Average retail electricity prices are predicted to increase an average of 6.5 percent over the same period.

It is useful to put these predicted impacts into perspective. For example, the predicted effect of the four policies on Henry Hub natural gas prices is $0.48/MMBtu. By way of context, the EIA reduced its forecast of future Henry Hub natural gas prices by approximately $2/MMBtu from AEO 2009 to AEO 2011.

2. Uncertainties Regarding Energy Market Impacts

The projected energy market impacts due to the four environmental policies are significant. The impacts arise both because of substantial compliance costs—that lead a substantial number of coal-fired units to retire and force other coal units to incur substantial retrofit costs in order to comply—and because of the market reactions to these initial impacts.

The impacts depend upon many factors, including the baseline conditions—including projected future natural gas prices—as well as the details of the market reactions to the policy changes that are embedded in the NEMS model. The baseline also includes assumptions on the nature of future regulatory requirements. As noted above, we modified the baseline in NEMS to evaluate the impacts of these air emission policies relative to the absence of similar SO_2 and NOx policies (no CAIR from 2012 onward); EPA made the same assumption in its recent analysis of CSAPR. We have included state mercury requirements in the baseline, which tend to decrease the impacts relative to a baseline without the state requirements.

The electricity market impacts also depend upon a host of specific elements of the electricity systems in various regions. Some of these elements are included in the assessments, such as the nature of the state regulatory regime. The NEMS results, however, do not include considerations related to highly location-specific factors such as transmission security and the time constraints on retiring units, particularly relatively large units (ICF 2011).

3. Regional Results

NEMS provides energy price results for various regions, including 22 electricity price regions. The electricity price impacts of the four policies differ by region depending upon many factors including the following:

- reliance on coal-fired generation under baseline conditions;
- coal unit retirements;
- need for replacement capacity;
- type of replacement capacity that NEMS builds;
- retrofits for coal units that continue to operate as well as the costs of those retrofits;
- capacity factors for coal units;
- regional fuel prices;
- interregional electricity trade; and
- regulatory regime.

Table 4 provides estimates of the percentage increases in retail electricity rates in the 22 NEMS electricity regions due to the four policies. As with the prior results, these figures are based upon the average percentage changes over the period from 2012 to 2020. (Detailed annual impacts are provided in Appendix C, with effects that are both higher and lower than these average values.)

Table 4. Average Electricity Price Impacts, 2012-2020

		2010$/MWh	%
	US Average	+$5.65	+6.5%
NEMS Regions			
NEWE	New England	+$2.93	+2.2%
NYCW	NYC	+$6.97	+4.2%
NYLI	NY Long Island	+$13.00	+8.0%
NYUP	NY Upstate	+$6.39	+5.6%
RFCE	Mid-Atlantic	+$10.38	+10.7%
SRVC	VA & Carolinas	+$4.05	+5.1%
SRSE	Southeast	+$6.94	+8.2%
FRCC	Florida	+$4.10	+3.9%
RFCM	Lower MI	+$7.63	+9.6%
RFCW	OH, IN, & WV	+$7.01	+8.6%
SRCE	KY & TN	+$8.36	+13.5%
MROE	WI & Upper MI	+$6.96	+9.2%
MROW	Upper Midwest	+$5.39	+7.8%
SRGW	South IL & East MO	+$6.73	+11.1%
SPNO	KS & West MO	+$6.42	+8.0%
SRDA	AR, LA, & West MS	+$5.16	+7.2%
SPSO	Oklahoma	+$8.75	+12.6%
ERCT	Texas	+$5.34	+6.9%
RMPA	CO & East WY	+$1.40	+1.5%
NWPP	Northwest	+$0.04	+0.1%
AZNM	AZ & NM	+$1.40	+1.6%
CAMX	California	+$2.25	+1.6%

Source: NERA calculations as explained in text

C. Economic Impacts

As noted, we used the REMI PI+ model to estimate the potential near- and medium-term economic impacts of the four policies based upon the energy market impacts estimated in NEMS.

1. Results

Table 5 summarizes the effects of the four policies on various economic impact measures, including impacts on employment, GDP, and disposable personal income. The table includes information on the average annual changes over the period from 2012 to 2020 as well as the cumulative effects over the period (detailed annual impacts are provided in the appendices).

Table 5. U.S. Economic Impacts, 2012-2020

	Annual Average	Cumulative
Employment	-183,000 jobs	-1.65 million job-years
Gross Domestic Product	-$29 billion	-$190 billion
Disposable Personal Income	-$34 billion	-$222 billion
Disposable Personal Income per Household	-$270	-$1,750

Note: All dollar values are in 2010$.
The cumulative employment impact is an undiscounted sum from 2012 to 2020; the cumulative GDP and disposable personal income impacts are present values as of January 1, 2011 using a real annual discount rate of 7 percent.
Disposable personal income impacts per capita from REMI were converted to disposable personal income impacts per households based on a current average U.S. household size of 2.58 people (Census 2011).
Source: NERA calculations as explained in text

Over the period from 2012 to 2020, about 183,000 jobs per year are predicted to be lost on net due to the effects of the four regulations. The cumulative effects mean that over the period from 2012 to 2020, about 1.65 million job-years of employment would be lost. U.S. GDP would be reduced by $29 billion each year on average over this period, with a cumulative loss from 2012 to 2020 of $190 billion (2010$). U.S. disposable personal income would be reduced by $34 billion each year on average over this period, with a cumulative loss from 2012 to 2020 of $222 billion (2010$). The average annual loss in disposable personal income per household is $270, with a cumulative loss of $1,750 (2010$).

The four policies would lead to different net employment impacts on different sectors. Of the 70 sectors in the REMI PI+ model, sectors that would gain jobs account for about 55,000 added jobs per year on average, and sectors that would lose jobs account for about 238,000 fewer jobs per year on average. On a cumulative basis over the period from 2012 to 2020, the sectors that would gain jobs represent about 499,000 job-years, and the sectors that would lose jobs represent about 2,149,000 job-years.

2. Uncertainties Regarding Economic Impacts

The estimated economic impacts of the four environmental policies over the period from 2012 to 2020 are substantial. These impacts include many factors, including: the positive impacts of expenditures on environmental controls and replacement electricity capacity; the negative effects of reduced coal sales and reduced coal production; the positive effects of increased natural gas sales; both the negative effects of higher natural gas prices on consumers and the positive effects on producers; and the negative effects of electricity price effects on consumers. In addition, the timing of impacts depends upon how the capital costs of pollution controls and increased replacement capacity are financed. The overall impacts are thus a complicated result of a large number of positive and negative factors.

These estimates are subject to various types of uncertainties, including uncertainties regarding the energy market and other inputs. As noted above, the coal unit retirements and energy market impacts are subject to various uncertainties, which translate into uncertainties regarding the economic impacts. There are additional uncertainties regarding the modeling of these economic

impacts. The macroeconomic modeling does not, for example, take into account the potential negative effect on the overall productivity and growth of the economy of reduced productive investment due to the financing of pollution control expenditures. The model also does not presume that environmental compliance expenditures use any unemployed or idle resources. In addition, the model assumes that consumers can shift away from more expensive energy and thus reduce the negative impacts of higher natural gas and electricity prices, an assumption that may understate the likely negative impacts of the price increases.

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Appendix A: Compliance Measures and Cost Estimates

This appendix provides information on the data and methodologies used to model potential compliance measures and compliance costs at coal units for relevant environmental policies in the reference case and the four potential EPA regulations (CSAPR, MACT, CCR, and 316(b)). We begin with information related to the reference case and then provide information related to each of the potential EPA regulations. We present our cost assumptions for air emission control technologies, which we used as inputs for both the reference case and policy case, at the end of this appendix.

A. Reference Case

As discussed in the report body, we modeled the energy market impacts of the potential EPA regulations using the National Energy Modeling System (NEMS), a comprehensive U.S. energy model developed and maintained by the U.S. Energy Information Administration (EIA). With the exception of the environmental policy inputs discussed in this appendix, we used the same inputs to NEMS as EIA used for its *Annual Energy Outlook* (*AEO*) *2011* (EIA 2011a). Note that the inputs for *AEO 2011* which we did not modify include inputs related to various national, regional, and state environmental policies that are currently in place, such as state renewable portfolio standards and the Regional Greenhouse Gas Initiative.

The environmental policies in the reference case that are most relevant to the potential EPA regulations are the Clean Air Interstate Rule (CAIR) to reduce SO_2 and NO_x emissions from power plants and policies to reduce mercury emissions from power plants. EIA describes its inputs related to these policies for *AEO 2011* in EIA (2011b, pp. 104-107). Table A-1 summarizes our compliance assumptions related to these policies for our reference case.

Table A-1. Compliance Assumptions for Reference Case

Policy	Emission	Compliance Assumptions
CAIR	SO_2	Apply Phase 1 SO_2 cap (3.6 million tons) through 2011 and allow NEMS to determine which units would need to install SO_2 control technologies or switch to lower-sulfur coal in the interstate cap-and-trade program; from 2012 onward, allow SO_2 cap to revert to pre-CAIR level (based on Acid Rain Program)
	NO_x	Apply Phase 1 NO_x cap (1.5 million tons) through 2011 and allow NEMS to determine which units would need to install NO_x control technologies in the interstate cap-and-trade program; from 2012 onward, allow NO_x cap to revert to pre-CAIR level (based on NO_x Budget Trading Program)
State policies	Mercury	Include mercury reductions as required by state policies and allow NEMS to determine which units would need to install mercury control technologies

Source: NERA assumptions as explained in text

1. Clean Air Interstate Rule

EPA promulgated CAIR in 2005 to reduce SO_2 and NO_x emissions from power plants in 28 Eastern states (EPA 2005).[1] EPA established interstate cap-and-trade programs for both types of emissions. The caps for both types of emissions became tighter over two phases. The NO_x program consisted of Phase 1 (2009-2014) with a cap of 1.5 million tons and Phase 2 (2015 onward) with a cap of 1.2 million tons. The SO_2 program consisted of Phase 1 (2010-2014) with a cap of 3.6 million tons and Phase 2 (2015 onward) with a cap of 2.5 million tons. In December 2008, the U.S. Court of Appeals for the D.C. Circuit remanded CAIR to EPA but did not vacate it, thus allowing the first phases of the NO_x and SO_2 programs to take effect while EPA developed a replacement rule.

Our modeling for the reference case reflects that the CAIR Phase 1 programs have taken effect. We applied the CAIR Phase 1 caps for SO_2 and NO_x emissions (using EIA's inputs for *AEO 2011*) through 2011 and allowed NEMS to decide which units would need to install SO_2 control technologies or switch to lower-sulfur coal in the interstate cap-and-trade program. Our NEMS inputs for the reference case also include the SO_2 and NO_x control technologies that coal units have installed or have announced that they will install to comply with CAIR requirements (or any state or local policies requiring reductions in these emissions). EIA (2011, p. 106) summarizes the recent and planned retrofits for SO_2 and NO_x policies that are in NEMS.

As discussed in the report body and below, EPA has promulgated the Cross-State Air Pollution Rule (CSAPR) as a replacement for CAIR to take effect in 2012 (EPA 2011a). CSAPR would cover a somewhat different set of Eastern states than CAIR but would also involve interstate cap-and-trade programs and would set the caps at similar levels to CAIR. Thus, including CAIR in our reference case from 2012 onward would make it difficult to isolate the incremental impacts of CSAPR. We therefore terminated the CAIR Phase 1 caps after 2011 in our reference case and reverted SO_2 and NO_x caps to pre-CAIR levels (based on the Acid Rain Program and NO_x Budget Trading Program, respectively). Note that EPA also removed future CAIR caps from its reference case for modeling the incremental impacts of CSAPR (EPA 2011b, pp. 30-32).

2. State Mercury Policies

Seventeen states have enacted policies to limit mercury emissions from coal units (EPA 2011c, pp. 3-8). These state mercury policies vary significantly in their form, stringency, and schedule. Some policies took effect as early as 2008, while others will take effect as late as 2017.

EIA incorporated these state mercury policies into *AEO 2011*, and we used the same inputs for our reference case. To comply with these state mercury policies, some coal units install mercury control technologies such as activated carbon injection (ACI) and fabric filters in the reference case. We allowed NEMS to determine the compliance measures at coal units based on parameters built into NEMS on mercury emission rates for different types of coal and different

[1] SO_2 emissions from power plants in Western states are regulated under the Acid Rain Program (EPA 2010a). We did not modify the SO_2 caps for Western power plants in NEMS for our reference case or policy case.

configurations of environmental control technologies, including scrubbers and SCR (EIA 2011b, p. 105-106).

Note that when NEMS determines based on its compliance calculations that coal units will install scrubbers, the scrubbers are assumed to be wet scrubbers (EIA 2011a, p. 46). Thus, reductions in mercury emissions from scrubbers that NEMS builds to comply with state mercury requirements reflect parameters for wet scrubbers. When NEMS calculates mercury emissions from coal units with existing or planned dry scrubbers, however, the mercury emissions accurately reflect parameters for dry scrubbers. Modeling issues related to wet and dry scrubbers are discussed further in the context of MACT HCl compliance below.

B. Cross-State Air Pollution Rule

EPA promulgated CSAPR as a replacement for CAIR in August 2011 (EPA 2011a). As noted above, CSAPR would cover a somewhat different set of Eastern states (27 in total) than CAIR but would also involve interstate cap-and-trade programs and would set the caps at similar levels to CAIR. CSAPR would set caps on emissions in each state but would allow interstate trade of emission allowances provided that state emissions stay within so-called variability limits. Covered units would not be able to use allowances from the Acid Rain Program, NO_x Budget Trading Program, or CAIR for compliance with CSAPR. The caps for both SO_2 and NO_x would become tighter over two phases. The SO_2 program would consist of Phase 1 (2012-2013) with a cap of 3.4 million tons and Phase 2 (2014 onward) with a cap of 2.1 million tons. The annual NO_x program would consist of Phase 1 (2012-2013) with a cap of 1.2 million tons and Phase 2 (2014 onward) with a cap of 1.1 million tons.

Table A-2 summarizes our compliance assumptions for CSAPR.

Table A-2. Compliance Assumptions for CSAPR

Policy	Emission	Compliance Assumptions
CSAPR	SO_2	Apply SO_2 caps (3.4 million tons in 2012-2013 and 2.1 million tons from 2014 onward) and allow NEMS to determine which units would need to install SO_2 control technologies or switch to lower-sulfur coal in the interstate cap-and-trade program (within state variability limits); in order to discourage unrealistic fuel switching in the model in 2012-2013, do not allow banking of CSAPR SO_2 allowances in those years
	NO_x	Apply NO_x caps (1.2 million tons in 2012-2013 and 1.1 million tons from 2014 onward) and allow NEMS to determine which units would need to install NO_x control technologies in the interstate cap-and-trade program (within state variability limits); allow banking of CSAPR NO_x allowances

Source: NERA assumptions as explained in text

1. CSAPR SO_2 Compliance

We modeled the CSAPR SO_2 program in NEMS as an interstate cap-and-trade program with state variability limits and two phases. We allowed NEMS to determine which units would install SO_2 control technologies and which would switch to lower-sulfur coal.

CSAPR modeling by EPA indicates substantial switching among various coals in 2012 and 2013 based on their sulfur content (EPA 2011b and NERA analysis of underlying data). Although EPA's modeling results seem reasonable for the total amounts of low-sulfur and ultra-low-sulfur coal, it may not be feasible to achieve the extent of fuel switching implied in EPA's modeling due to the prevalence of long-term fuel contracts, rail networks, and other real-world practicalities for coal units to switch their coal types on such a large scale in the early years of the program. Coal units appear to switch fuels in the early years in EPA's analysis to build up a large bank of CSAPR SO_2 allowances. To avoid what seems to be potentially unrealistic fuel switching in our modeling, we include fuel switching to meet the 2012 and 2013 caps but not to build up a bank of CSAPR SO_2 allowances in the early years of the program.

2. CSAPR NO_x Compliance

We modeled the CSAPR NO_x program in NEMS as an interstate cap-and-trade program with state variability limits and two phases. We allowed NEMS to determine which units would install various NO_x control technologies. Since fuel switching is not an issue for NO_x programs, we allowed banking of CSAPR NO_x allowances in all years.

C. Utility MACT

EPA proposed the Utility Maximum Achievable Control Technology (MACT) rule in May 2011 to reduce emissions of mercury and other hazardous air pollutants (including mercury, other hazardous metals, and acid gases) from coal- and oil-fired power plants across the country. The rule would set emission rate standards for different types of coal and oil based on maximum achievable control technology. The emission rate standards would apply to mercury, particulate matter (PM) as a proxy for all non-mercury hazardous metals, and hydrogen chloride (HCl) as a proxy for all acid gases. Covered power plants would have up to three years to comply with the rule, but permitting authorities could grant one-year extensions to power plants if they required additional time. Table A-3 shows the proposed emission rate standards for mercury, particulate matter, and hydrogen chloride from existing coal units under the Utility MACT rule.

Table A-3. Proposed Utility MACT Emission Rate Standards for Existing Coal Units

Coal Rank	Mercury	Hydrogen Chloride	Particulate Matter
Bituminous and subbituminous	1.2 lb/TBtu	0.0020 lb/MMBtu	0.030 lb/MMBtu
Lignite	4.0 lb/TBtu	0.0020 lb/MMBtu	0.030 lb/MMBtu

Notes: TBtu: trillion British thermal units of fuel input
MMBtu: million British thermal units of fuel input
The mercury standard for lignite shown in the table is the "beyond-the-floor" limit; the MACT standard based on the top 12 percent of units would be 11.0 lb/TBtu.
The mercury standard for bituminous and subbituminous coal is the update from the original value of 1.0 lb/TBtu based on EPA's letter of May 18, 2011 (EPA 2011e).
Source: EPA (2011d), p. 25027

Table A-4 summarizes our assumptions for MACT.

Table A-4. Compliance Assumptions for MACT

Policy	Emission	Compliance Assumptions
MACT	Mercury	Apply mercury standards in 2015 at all units and allow NEMS to determine which units would need to install ACI, fabric filters, and/or scrubbers
	HCl	Assign costs for DSI in 2015 at unscrubbed units smaller than 300 MW that consume subbituminous coal (these units requiring DSI will also require fabric filters); require dry scrubbers at all non-DSI units that consume Western bituminous coal, subbituminous coal, or lignite (these units requiring dry scrubbers will also require fabric filters); require wet scrubbers at all units that consume Eastern bituminous coal (these units requiring wet scrubbers will not require fabric filters, but NEMS may retrofit them with fabric filters for mercury or they may require fabric filters for MACT PM compliance)
	PM	In addition to requiring fabric filters at all units with DSI or dry scrubbers, and in addition to requiring fabric filters (in combination with ACI) at some units for MACT mercury compliance, require fabric filters for MACT PM compliance at the necessary number of coal units so that the same percentage of total U.S. coal capacity has fabric filters in 2015 as in the EPA MACT RIA; use EPA's list of coal units installing fabric filters from the MACT RIA to identify the additional coal units that would require fabric filters

Source: NERA assumptions as explained in text

1. MACT Mercury Compliance

As noted above in the context of state mercury policies for the reference case, NEMS estimates mercury emissions from coal units and can determine which units would install ACI, fabric

filters, and/or scrubbers to comply with mercury reduction requirements. We required mercury reductions at all U.S. coal units based on the mercury standards in Table A-3. We assumed that compliance with the mercury standards would be required by 2015. Note that our inclusion of state mercury policies in the reference case dampens the impacts of the national MACT mercury standards in the policy case, because some coal units install ACI, fabric filters, and/or scrubbers anyway in the reference case to comply with the state mercury policies.

2. MACT HCl Compliance

NEMS does not model HCl emissions from coal units. Indeed, HCl emission rates from individual units can vary significantly over time as the unit burns coal from different mines and seams with different chlorine contents. Since NEMS does not model HCl emissions from coal units and thus cannot determine which controls would be required for compliance with HCl policies, we developed rules to assign HCl control technologies to individual units based on review of technology assumptions in EPA's regulatory impact analysis (RIA) for the MACT proposal (EPA 2011f) and other analyses, including comments on the MACT proposal submitted to EPA from various organizations (in Docket No. EPA-HQ-OAR-2009-0234). We assumed that compliance with the HCl standard would be required by 2015.

We assumed that every coal unit would require either dry sorbent injection (DSI), a dry scrubber, or a wet scrubber to comply with the HCl standard. Note that the variability in HCl emission rate at individual coal units over time would tend to cause owners to make relatively conservative assumptions about compliance measures so that they do not exceed the standard when the chlorine content of their coal happens to be high. DSI has significantly lower capital costs than a dry scrubber, which in turn has lower capital costs than a wet scrubber (EPA 2011c).[2] Since NEMS does not include DSI among its set of emission control technologies, we could not directly apply DSI to coal units in NEMS. Instead, we assigned costs to units requiring DSI to represent installation of DSI.

We assumed that DSI would be installed for HCl compliance at unscrubbed units smaller than 300 MW that consume subbituminous coal. The size limit for DSI is the same as the Bipartisan Policy Center's assumption for its analysis of potential EPA regulations (BPC 2011, p. 24); the Edison Electric Institute made a similar assumption for one of its modeling scenarios by limiting DSI to units smaller than 200 MW (EEI 2011, p. 4). We assumed that dry scrubbers would be installed for HCl compliance at all unscrubbed and non-DSI units that consume Western bituminous coal, subbituminous coal, or lignite. We further assumed wet scrubbers would be installed for HCl compliance at all unscrubbed units that consume Eastern bituminous coal. DSI and dry scrubber installations would also require fabric filters.

As noted above, NEMS assumes that all new scrubbers are wet scrubbers (EIA 2011a, p. 46). Scrubber cost inputs for the Retirement Model, however, accurately reflect whether the unit would need to install a wet scrubber or dry scrubber (or DSI). Moreover, we modified the unit-specific cost inputs in NEMS so that units needing to install wet scrubbers, dry scrubbers, or DSI had the appropriate costs.

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[2] Additional information on the costs of air emission control technologies appears at the end of this appendix.

3. MACT PM Compliance

NEMS does not model PM emissions from coal units and thus cannot determine which controls would be required for compliance with PM policies. The main control technologies for PM emissions are electrostatic precipitators (ESPs) and fabric filters (also called baghouses). NEMS includes fabric filters among its set of emission control technologies, but since NEMS does not model PM emissions, it only installs fabric filters on its own to reduce mercury emissions. We therefore developed rules to assign fabric filters to individual units based on reviews of technology assumptions in EPA's MACT RIA (EPA 2011f) and other analyses. We assumed that compliance with the PM standard would be required by 2015.

We assumed that most, but not all, coal units would require a fabric filter for PM compliance. Since NEMS installs fabric filters (in combination with ACI) on some coal units for compliance with state mercury policies and MACT mercury standards, these units would comply with the PM standard as well. We also required installation of fabric filters at units installing DSI or dry scrubbers for HCl compliance, and so these units too would comply with the PM standard. Thus, the only remaining coal units without fabric filters at this point are units with wet scrubbers (either existing wet scrubbers or new wet scrubbers for HCl compliance) and with sufficiently low mercury emission rates without fabric filters based on the NEMS parameters and determinations for mercury compliance. We reviewed EPA's MACT RIA data and assumed installation of fabric filters at the remaining coal units if they had fabric filters in the EPA data. The percentage of total U.S. coal capacity having fabric filters in our policy case is therefore approximately the same as the percentage in EPA's MACT RIA.[3]

Note that installing fabric filters at most U.S. coal units by 2015 is assumed to be feasible, despite the analysis by industry experts that such a large number of fabric filters could not be manufactured and installed in such a short period (UARG 2011).

D. Coal Combustion Residuals

EPA has considered several alternative forms of regulations in recent years for the disposal of coal combustion residuals (CCR), which include fly ash, bottom ash, boiler slag, and scrubber waste. The alternative forms of CCR regulations differ in their classification of CCR under Subtitles C or D of the Resource Conservation and Recovery Act (hazardous and non-hazardous, respectively) and compliance measures (for example, requiring liners at all surface impoundments or only at new surface impoundments). EPA proposed three alternative forms of CCR regulations in June 2010 (EPA 2010b). The unit-specific information in the RIA for this proposed rule, however, was based on a prior set of alternative forms that EPA developed in 2009 (EPA 2010c, p. 3).

Table A-5 summarizes our compliance assumptions for CCR regulations.

[3] EPA (2011f, pp. 8-18 and 8-14) gives the total U.S. coal capacity in 2015 in the MACT scenario as 299 GW, and 243 GW have fabric filters. Thus, 81 percent of total U.S. coal capacity in 2015 would have fabric filters in EPA's MACT scenario.

Table A-5. Compliance Assumptions for CCR Regulations

Policy	Compliance Assumptions
CCR	Assign costs to units in 2015 based on EPA Subtitle D in initial proposal

Source: NERA assumptions as explained in text

We modeled CCR compliance costs at coal units in 2015 based on EPA's unit-specific information for the initial form of CCR regulation under Subtitle D of the Resource Conservation and Recovery Act (EPA 2010c, Exhibit J3). As noted above, EPA only provided unit-specific information for the initial set of alternatives it developed in 2009; EPA did not provide unit-specific information for the final set of alternatives that it proposed in 2010. The initial form of CCR regulation under Subtitle D would lead to a cost of $30 billion (present value in 2009 dollars).[4] Note that this cost lies near the middle of the range of cost estimates for CCR regulation. For example, EPA (2010b, p. 10) gives the cost of the final form of Subtitle C regulation as $20 billion, and EPRI (2010, p. 4-3) gives the cost of Subtitle C regulation as between $55 billion and $77 billion.

We used this unit-specific cost information from EPA (2010c, Exhibit J3) as the basis for the potential costs of CCR regulation.

E. Section 316(b)

EPA proposed alternative forms of regulations for cooling water intake under Section 316(b) of the Clean Water Act in April 2011 (EPA 2011g). The regulations would affect the design of cooling water intake structures (to reduce impingement of aquatic organisms against intake structures) and the flow rates through cooling water systems (to reduce entrainment of aquatic organisms into cooling water systems) at power plants and other large facilities. The alternative forms of 316(b) regulations differ in their requirements for intake structures and flow rates, including possible use of best professional judgment for determining best technology available on a site-specific basis.

Table A-6 summarizes our compliance assumptions for 316(b) regulations.

Table A-6. Compliance Assumptions for 316(b) Regulations

Policy	Compliance Assumptions
316(b)	Assign costs to units in 2015 based on EPA Option 1 for impingement and 46 facilities installing cooling tower retrofits for entrainment

Source: NERA assumptions as explained in text

[4] EPA (2010b, Exhibit J3) gives the total annualized cost of the initial form of the Subtitle D alternative as $2.2 billion in 2009 dollars. EPA annualized these costs over 50 years. Using a real annual discount rate of 7 percent, this implies a present value of $30 billion.

We modeled 316(b) compliance costs for coal units in 2015 based on EPA information in the proposed rule related to Option 1, which includes a national requirement to reduce impingement, and an assumption that a total of 46 facilities would install cooling towers for entrainment under site-specific determinations. EPA (2011g, p. 22219) shows that Option 1 would lead to costs of $5 billion (present value in 2009 dollars) for electric generators to reduce impingement.[5] We estimated the apportionment of these costs across generation units, including coal units as well as natural gas, oil, and nuclear units, based on unit-specific cooling water intake data from EIA Form 860 (EIA 2011c).

EPA (2011g, p. 22211) noted that if the 46 fossil units with the largest cooling water withdrawals from tidal waters installed cooling towers to reduce entrainment, their total cost would be $7 billion.[6] Note that of the two hypothetical cooling tower scenarios for which EPA provided information, this scenario involved fewer facilities and lower total costs. We identified the 46 fossil units with the largest cooling water intake withdrawals from tidal waters using EIA Form 860 (EIA 2011c) and apportioned costs to individual units based on their intake data.

We used this unit-specific cost information based on EPA (2011g) as the basis for our modeling of the potential costs of 316(b) regulation.

F. Cost Assumptions for Air Emission Control Technologies

As discussed above, we relied on unit-specific inputs in NEMS for information about coal units for modeling retirements and energy market impacts. We modified the potential costs of air emission control technologies in NEMS to base them on EPA (2011c).

Table A-7 shows EPA and EIA assumptions for the costs of air emissions controls. These cost estimates include energy penalties for net capacity and heat rate due to some of the controls. Some types of costs show economies of scale (i.e., unit costs per kW are smaller for large units than small units), but other types of costs are uniform for all sizes of units. We used these cost assumptions from EPA in our modeling.

Note that the sudden large increase in demand for control technologies and skilled construction workers implied by our technology assumptions may not be feasible within the limited time assumed in our study and, in any event, the increased demand could drive up prices for control technologies. We did not develop any estimates of this "gold rush" effect. We assumed that the retrofits would be feasible on such a large scale and that there would be no price inflation due to the sudden increase in demand.

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[5] EPA (2011g, p. 22219) gives the total annualized cost of Option 1 for electric generators as $386 million in 2009 dollars. EPA annualized these costs over 50 years. Using a real annual discount rate of 7 percent, this implies a present value of $5 billion.

[6] EPA (2011g, p. 22211) gives the total annualized cost of the 46 facilities installing cooling towers as $480 million in 2009 dollars. EPA annualized these costs over 50 years. Using a real annual discount rate of 7 percent, this implies a present value of $7 billion.

Table A-7. Air Emission Control Costs

	100 MW		300 MW		500 MW	
	EPA	EIA	EPA	EIA	EPA	EIA
Wet Scrubber						
Capital (2010$/kW)	$850	$762	$622	$580	$538	$485
Fixed O&M (2010$/kW-year)	$24.40	$24.99	$11.20	$24.99	$8.35	$24.99
Variable O&M (2010$/MWh)	$2.11	$0.44	$2.11	$0.44	$2.11	$0.44
Capacity Penalty	-1.84%	-5.00%	-1.84%	-5.00%	-1.84%	-5.00%
Heat Rate Penalty	1.87%	5.26%	1.87%	5.26%	1.87%	5.26%
Dry Scrubber						
Capital (2010$/kW)	$727	-	$532	-	$460	-
Fixed O&M (2010$/kW-year)	$17.71	-	$8.86	-	$6.76	-
Variable O&M (2010$/MWh)	$2.70	-	$2.70	-	$2.70	-
Capacity Penalty	-1.45%	-	-1.45%	-	-1.45%	-
Heat Rate Penalty	1.47%	-	1.47%	-	1.47%	-
SCR						
Capital (2010$/kW)	$268	$225	$217	$184	$201	$165
Fixed O&M (2010$/kW-year)	$2.60	$2.25	$0.83	$1.88	$0.73	$1.66
Variable O&M (2010$/MWh)	$1.38	$0.34	$1.38	$0.34	$1.38	$0.34
Capacity Penalty	-0.58%	0.00%	-0.58%	0.00%	-0.58%	0.00%
Heat Rate Penalty	0.59%	0.00%	0.59%	0.00%	0.59%	0.00%
ACI						
Capital (2010$/kW)	$30	$6	$12	$6	$8	$6
Fixed O&M (2010$/kW-year)	$0.12	$1.71	$0.05	$1.71	$0.03	$1.71
Variable O&M (2010$/MWh)	$0.52	$0.26	$0.56	$0.26	$0.60	$0.26
Capacity Penalty	-0.06%	0.00%	-0.06%	0.00%	-0.06%	0.00%
Heat Rate Penalty	0.06%	0.00%	0.06%	0.00%	0.06%	0.00%
Fabric Filter						
Capital (2010$/kW)	$230	$78	$187	$78	$170	$78
Fixed O&M (2010$/kW-year)	$0.94	$5.97	$0.83	$5.97	$0.73	$5.97
Variable O&M (2010$/MWh)	$0.16	$0.00	$0.16	$0.00	$0.16	$0.00
Capacity Penalty	-0.60%	0.00%	-0.60%	0.00%	-0.60%	0.00%
Heat Rate Penalty	0.60%	0.00%	0.60%	0.00%	0.60%	0.00%
DSI						
Capital (2010$/kW)	$134	-	$61	-	$43	-
Fixed O&M (2010$/kW-year)	$2.39	-	$0.94	-	$0.61	-
Variable O&M (2010$/MWh)	$7.70	-	$7.70	-	$7.70	-
Capacity Penalty	-0.79%	-	-0.79%	-	-0.79%	-
Heat Rate Penalty	0.79%	-	0.79%	-	0.79%	-

Note: "-" denotes that NEMS does not model the control technology.
Source: EPA (2011c) and NEMS inputs

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Appendix B: Coal Unit Retirement Model

NERA has developed a retirement model to estimate the possible coal unit retirements due to the potential costs of EPA regulations. The model uses Monte Carlo uncertainty analysis to simulate the decision facing coal unit owners on whether to incur the costs to comply with additional future environmental requirements (and other future costs) or to retire the unit.

The sections below are organized as follows: Section A describes the main decision module, and Section B describes the sub-modules that generate the specific estimates used to run the Monte Carlo simulations in the main decision module.

A. Retirement Decision Module

The owner of each coal unit is presumed to base its decision on whether or not to retire the unit by comparing the future costs for the unit—taking into account potential additional environmental compliance costs as well as other costs—to the future costs of the likely alternative generation. The retirement decision module calculates the expected net present value (NPV) of costs for existing coal units as well as the NPV of costs for the likely alternative. Based upon likely future fuel market conditions, the alternative unit for comparison is assumed to be a combined cycle gas turbine (CCGT) unit. The cost calculations for coal and gas are done separately, but correlations in variables subject to uncertainty are taken into account. All retrofit costs are assumed to be incurred in 2015.

1. Net Present Value of Costs for Existing Coal Units

The NPV of costs for existing coal unit i is given by the following expression:

Equation 1. NPV of existing coal costs

$$d_{ir}R_i + \sum_{t=1}^{T_i} d_{it}(C_{it} + O_{it} + E_{it})$$

Where:

- R_i is the capital cost of retrofits. The total cost of retrofits for a given plant depends on the plant's current configuration, the randomly drawn retrofit costs for that plant from the retrofit/construction cost module, and what regulatory requirements the plant has in the regulatory scenario of interest. The cost of retrofits is then just the sum of the costs for each individual retrofit technology required at the plant.

- d_{ir} is the discount rate for unit i in year r, where r is the year in which retrofits take place. It is given by:

$$\left(\frac{1}{1+r}\right)^{t-1}$$

where t indicates time in years, where the first year in the model is t=1. The discount rate for a given unit depends on whether the utility that owns the unit is private or public. Following the NEMS model, we take the mean of the (real) discount rate to be 7 percent for units owned by public power organizations (e.g., the Tennessee Valley Authority and rural electric cooperatives) and 11.8 percent for units owned by private (investor-owned) companies, including units owned by regulated utilities with private (investor-owned) parent companies.

- d_{it} is the discount rate for unit i in year t, defined as above for d_{ir}.

- T_i is the remaining lifetime of unit i in years.

- C_{it} is the cost of coal for unit i in year t. The cost of coal is calculated by the hourly operation module when run decisions are calculated. It is essentially the average cost of coal across all operating hours weighted by the capacity factor at each hour. These plant-specific costs are developed as described in the coal cost module section. For the small number of plants with missing coal costs, average regional costs are used. If a retrofit increases the plant heat rate it will increase coal costs.

- O_{it} is the operating and maintenance (O&M) cost for unit i in year t. This is calculated as the sum of variable O&M and fixed O&M. Some retrofits result in additional O&M costs; where this is the case, variable O&M and/or fixed O&M are increased accordingly. We use EPA's O&M cost assumptions from the MACT analysis. Variable O&M costs for a year are calculated as the sum of hourly variable O&M costs. If we take V_{ih} to be the variable O&M costs for unit i in hour h (in dollars per megawatt-hour), then V_{it}, the variable O&M costs for unit i in year t, are given by:

  $$\sum_{h=1}^{8760} TC_i(L_{ih} \cdot V_{ih})$$

  where TC_i is the total capacity for plant i and L_{ih} is the capacity factor for plant i in hour h.

- E_{it} is the cost of system energy for unit i in year t necessary to compensate for capacity factors less than one at any hour. In order to make an appropriate comparison between existing coal and new gas, the costs of both gas and coal in our model are calculated as the costs to generate TC_i times 8760 energy per year. This assures that the retirement decision accounts for differences in the capacity factors of new and existing units. Thus, included in the calculation of the costs of existing coal is the cost of system energy necessary to compensate for capacity factors less than one at any hour. E_{it} is calculated as:

  $$PM_{it} \cdot PE_{it} \cdot G_{it}$$

  Here, G_{it} is the generation by unit i in year t, PM_{it} is the ratio of the weighted average system energy cost to the overall average electricity price across all simulation draws at the power hub to which plant i is assigned ($WASC_{ij}/ASEC_{it}$), and PE_{it} is the average marginal cost of energy in the NERC region to which i belongs in year t (from the NEMS model outputs). The value of G_{it} is an output of the hourly operation module and is calculated as:

  $$G_{it} = \sum_{h=1}^{8760} TC_i(L_{ih})$$

  The weighted average system energy cost is calculated as:

$$WASC_{ijt} = \frac{\sum_{h=1}^{8760}(1 - L_{ijh})P_{ijh}}{\sum_{h=1}^{8760} L_{ijh}}$$

whereas the overall average system energy cost is:

$$ASEC_{it} = \frac{1}{8760} \cdot \frac{1}{100} \cdot \sum_{j=1}^{100} \sum_{h=1}^{8760} P_{ijh}$$

where P_h is the marginal cost of energy at hour h from the electricity price module. Thus, the factor of $PM_{it} \cdot PE_{it}$ in the calculation of E_{it} serves to calibrate the outputs of the electricity price and hourly operation modules to NEMS electricity prices and map the five power hubs to the twenty-two NERC regions.

2. Net Present Value of Costs for Potential Alternative Unit (New CCGT)

The NPV of costs for replacing existing coal unit i with new CCGT of equal capacity is calculated as:

Equation 2. NPV of replacement CCGT costs

$$\sum_{t=1}^{T_i} d_{it}(CG_{it} + OG_{it} + EG_{it} + ON_{it})$$

Where d_{it} and T_i are identical to that for existing coal, and:

- CG_{it} is the average delivered cost of gas for the region in which unit i is located in year t using the appropriate capacity factor and heat rate.
- OG_{it} is the total O&M costs in year t for a CCGT constructed to replace unit i. This incorporates both fixed and variable O&M costs. The variable O&M costs are a function of the hourly capacity factors for a new CCGT in year t. These capacity factors are modeled based on the predicted operation of a sample of recently constructed CCGTs in each region and are an output of the hourly operation module. Thus, there are actually several calculations of replacement CCGT costs to compare to each coal plant, one for each CCGT in the sample of recently constructed CCGTs in each region.
- EG_{it} is the cost of grid energy to bring total generation to TC_i times 8760. This is calculated in the same way as the cost of grid energy for coal plants.
- ON_{it} is the equivalent annual overnight capital cost payment in year t for a CCGT replacement for plant i. The overnight costs are always annualized over the entire lifetime of the gas plant (30 years, consistent with the NEMS model), and are based on the sampled CCGT overnight costs drawn in the retrofit/construction cost module. However, since T_i may be less than 30 (and the modeling horizon only encompasses 25 years), the entire capital cost of the plant is not reflected in this calculation. This avoids inappropriately overstating the equivalent annual cost of a CCGT plant built to replace an existing coal plant.

3. Monte Carlo Retirement Decision Calculation

The NPV of costs for existing coal and for replacement CCGT are compared in each of the 100 simulation draws used in the Monte Carlo formulation. The costs for CCGT are based on the minimum of costs calculated using the sampled recently constructed CCGTs in each region as the basis for hourly operation of a new CCGT. Since a new CCGT would be at least as efficient as any existing CCGTs, this calculation is conservative (in the sense that it might overstate the future costs of a future CCGT and thus understate the likelihood of retirement).

The owner is presumed to retire the coal unit based upon a comparison of the NPV of the costs of the coal unit and the costs of the replacement CCGT plant. In particular, the retirement decision sub-module calculates the difference in costs for each of the 100 equally-likely Monte Carlo draws. The coal unit is presumed to retire if the expected value of this cost difference is positive, i.e., the coal unit is expected to be more expensive than the replacement natural gas unit.

B. Individual Cost Component Sub-Modules.

The Retirement Model includes separate sub-modules to model the various elements that influence the cost of continuing to operate an existing coal unit and the cost of replacing the exiting coal unit with a new combined cycle gas turbine (CCGT) unit. The methodology in each sub-module for energy prices results in mean values based upon the NEMS model using AEO 2011, with the sub-modules focusing on developing estimates of the potential alternative price paths. These sub-modules are summarized and described below.

1. *Natural gas price simulation sub-module.* This sub-module simulates possible future natural gas price paths. The formulation assumes that future natural gas prices can be modeled as an autoregressive process.

2. *Coal price sub-module.* This sub-module models regional coal prices. The formulation assumes that future coal prices can be modeled as a vector autoregression (VAR) process. Coal prices in several regions are modeled as dependent time series.

3. *Electricity price sub-module.* This sub-module models hourly electricity prices. The empirical formulations are based upon data from five major trading hubs across the United States.

4. *Hourly power plant operation sub-module.* This sub-module models the hourly operation of existing coal plants greater than 25 megawatts (MW) capacity. The sub-module also models operation of CCGT units in each region on the basis of recently constructed units.

5. *Retrofit and construction costs sub-module.* This sub-module models retrofit costs for emission control technologies and construction costs for new CCGT units as random variables, with the construction parameters assumed to be correlated. (Costs for the same type of control at different plants are assumed to be more highly correlated than costs for different controls and for controls and new construction costs.) The parameters for the model are taken from EPA cost assumptions for the MACT analysis and recent engineering reports.

The following sections provide additional information on these sub-modules.

1. Natural Gas Price Simulation Sub-Module

The natural gas price module models natural gas prices as an autoregressive process of order one (AR-1 process). The model for price at time t is:

Equation 3. Natural gas price model

$$\log(p_t) = \alpha + \gamma \log(p_{t-1}) + \varepsilon_t, \quad \varepsilon_t \sim N(0,\sigma^2)$$

The parameters of the model are a constant term (α), an autoregressive term (γ), and a random error term (ε_t), which is assumed to be normally distributed with zero mean and unknown variance (σ^2). The parameters are estimated from daily Henry Hub price data for the years 2005-2010. The estimated value of the autoregressive term is less than one, and therefore the model for gas price is mean-reverting.

Using the estimated parameter values, we then simulate 100 future daily natural gas price paths from 2011-2035 for use in the model. Simulation is relatively simple: starting from the last day's price in the historical data, simulate the first day of the forecast series by taking the log of the previous day's price, multiplying by the estimated value of γ, adding the estimated value of α, and adding a value drawn from $N(0,\sigma^2)$. This is repeated for the second day of the forecast using the simulated value from the first day, and so on until prices have been simulated through the end of 2035. This entire process is then repeated 100 times to give 100 daily price paths through 2035.

As noted above, we adjust the simulated natural gas price paths such that the expected gas price in each year matched the EIA forecast. The expression for the price at time t in our model is given by:

Equation 4. Expression for price in the natural gas model

$$p_t = \exp(\alpha + \varepsilon_t) p_{t-1}^{\gamma}$$

From this we have that the expression for the expected price at time t, given the price in the previous period, is:

Equation 5. Expression for expected value of price in period *t* given price in period *t-1*.

$$E(p_t \mid p_{t-1}) = \exp\left(\alpha + \sigma^2/2\right) p_{t-1}^{\gamma}$$

From this expression it is clear that any constant C added to the right hand side of the original log-log form of the model will result in the conditional expectation of p_t being multiplied by $\exp(C)$. Thus, we simulate many price paths and take the mean price in each year (which is a consistent estimator of the expectation of price in any year). We then add a constant C_y to the right hand side of Equation 3 for every day in year y such that the expected price in year y

matches the NEMS price in year y. We then simulate 100 price paths from this calibrated form of the model.

2. Coal Price Sub-Module

The variability in coal prices is modeled using information for the two main coal contracts for bituminous and sub-bituminous coal (Central Appalachian/Big Sandy and Powder River Basin (PRB), respectively) using a vector autoregression (VAR). (Lignite coal variability is assumed to be the same as sub-bituminous.) The model assumes that coal prices are a stochastic process and that prices in the two regions are related. The mathematical form of the model is:

Equation 6. Coal price model

$$Y_t = c + AY_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim N_2(0, \Sigma)$$

Where Y_t is a 2x1 vector of prices (the Appalachian and PRB prices at time t), A is a linear transformation of the lagged price Y_{t-1}, c is a 2x1 vector of constants, and ε_t is a bivariate normal random variable with a 2x1 mean vector of zeroes and covariance matrix Σ. We use historical weekly coal price data from 2005-2010 to estimate the parameters of the model (c, A, and Σ).

We then simulate from this model 100 weekly price paths for 2011-2035 for PRB and Appalachian coal. As noted, the modeling assures that the mean prices are equal to those predicted in NEMS; we calculate the ratio of the average price in each year for each of the two coal contracts in our forecast to the average price from 2005-2010. We then add constants to the expression in equation 4 to make the ratios of the annual average price to the 2005-2010 average the same as the ratio of the annual mine mouth prices for bituminous and subbituminous coal in NEMS to the average prices for those coals from 2005-2010. Thus, the VAR model gives us the dependence structure and uncertainty in coal prices, whereas NEMS provides the means.

We then take a two-year moving average of the simulated coal prices in each of the 100 simulations and then take the ratio of this moving average to the overall average coal price for each year (across all simulations). We use the plant-specific average fuel costs from EIA 423 for 2005-2010 and multiply them by the ratio of the moving average from each of the 100 simulations to the overall moving average to get plant-specific coal prices for each week in the model. We use a long-term moving average to reflect that most coal prices for electric utilities are set by long-term contracts and an analysis of historical market prices compared to historical coal costs for electric utilities showed that a two-year moving average was a good predictor of relative coal price movements.

A small number of plants are missing cost data for delivered coal in EIA 423. We impute costs for delivered coal based on the quantity and type of coal delivered to each plant using an inverse-distance weighted average of the costs of the same type of coal delivered to nearby plants. We verified that the historical average delivered prices for the 22 NERC regions in the NEMS model calculated from EIA 423 (and using the above methodology to fill in missing prices) were very similar to NEMS average prices for the years 2005-2010 for those regions. The EIA data provides monthly coal costs; for consistency with the run decision model, we linearly interpolate between the monthly costs to obtain daily coal costs.

3. Electricity Price Sub-Module

The variability in hourly electricity prices is modeled using data for five hubs throughout the United States (ERCOT, PJM, Cinergy, SP15, and NYISO). Electricity prices are taken to be a function of the previous hour's electricity price, natural gas prices (with the magnitude of the effect varying with the hour), hour of day, season, whether the day is a weekend day or a weekday, and an innovation (error) term. The innovations are normal with zero mean and stochastic, time-varying variance. The mathematical specification is an exponential GARCH (EGARCH) model and is given by the following set of equations:

Equation 7. Electricity price model

$$\log(p_t) = X_t\beta + \alpha\log(p_{t-1}) + \varepsilon_t$$
$$\varepsilon_t = \sigma_t z_t \quad z_t \sim N(0,1)$$
$$\log(\sigma_t^2) = \omega + \gamma_g g(Z_{t-1}) + \gamma_s \log(\sigma_{t-1}^2)$$
$$g(Z_t) = \theta Z_t + \lambda\left(|Z_t| - E\left(|Z_t|\right)\right)$$

Where p_t is the price at time t, and X is a matrix of covariates. The structure of the model allows the sign and magnitude of the standard normal random variable Z_t to affect volatility (σ^2) separately. The model also allows for heteroskedasticity (through the dependence of σ_t^2 on σ_{t-1}^2) and volatility clustering (periods of large price swings and periods of relative calm).

The covariates in the mean regression (the matrix X_t) include dummy variables for hour of day, hour of day dummies interacted with natural gas prices, seasonal dummies, and weekday/weekend dummies. The model parameters are estimated on historical electricity price data for the five electricity price hubs for 2005-2010. We then simulate electricity price series for each of the five hubs from the model, using as inputs the simulated natural gas prices from the natural gas price model. We simulate 100 realizations of hourly prices for 2011-2015.

4. Hourly Power Plant Operation Sub-Module

The hourly power plant operation module models power plant hourly run decisions and output as a function of price and marginal costs. The relevant price variability in the model is determined by matching each power plant to one of the five regional hubs. As noted, the mean electricity prices are based upon NEMS AEO 2011.

The decision of whether to operate is modeled as a logistic regression:

Equation 8. Run decision model

$$r_t \sim bernoulli(p_t)$$
$$p_t = \Pr(r_t = 1) = \frac{e^{X_t\beta}}{1 + e^{X_t\beta}}$$

Where $r_t = 1$ indicates that the plant decides to run at time t. Here X_t is a vector of covariates, which in this case are constant, the hourly electricity price, and negative one times the sum of fuel costs and allowance costs per MWh for the plant at each hour. In the case of CCGT plants, the implied heat rate (ratio of the electricity price to the gas price) is used in place of the electricity price less costs.

Conditional on operating, we then model the capacity factor (output divided by capacity) as a mixture of linear regression models. In this model, each unit can operate in up to five distinct "modes," and the choice of "mode" is a function of the electricity price less costs (or, in the case of CCGT, the implied heat rate) and a constant specific to each mode. Conditional on choosing a "mode," the capacity factor is modeled as normally distributed with mean and variance estimated from the data. The mathematical representation of the model is:

Equation 9. Capacity factor model

$$m_t \mid r_t = 1 \sim multinomial(1, s_t)$$

$$s_{jt} = \Pr(m_t = j \mid r_t = 1) = \frac{e^{X_t \beta_j}}{\sum_{i \neq j} e^{X_t \beta_i}} \quad \beta_1 = \vec{0}$$

$$L_t \mid m_t = j, r_t = 1 \sim N(\mu, \sigma^2)$$

Where m_t is the operating mode at time t (m_t=1,...,5), s_t is a simplex vector (vector whose components add to one, making them plausible as probabilities for different alternatives), X_t is a matrix of covariates (here covariates are the electricity price less costs for coal plants or implied heat rate for CCGT and a dummy for the operating "mode" alternative), L_t is the capacity factor at time t and μ and σ^2 are the mean and variance of a normal distribution. The choice of this form for the model was based on the observation that power plant capacity factors exhibit multimodality, whereas electricity prices, the main factor in power plant operation decisions, do not. Thus, some type of model allowing for flexible multimodality was necessary, and the mixture of normal models is one such model that has well-established estimation techniques available.

We estimate the model on historical hourly power plant operation data for coal plants and a sample of recently constructed CCGTs for the years 2005-2010. The model predicts the historical capacity factors very accurately, with virtually all of the variance in the historical data explained by the model. We then simulate power plant operation for coal plants and sampled CCGTs using the simulated electricity, coal, and gas prices from the electricity and gas price modules for the years 2011-2035, as well as estimates of incremental variable cost of new controls, expected allowance prices, and heat rate penalties of new controls as factors affecting coal plant marginal costs. The result is 100 sets of hourly plant operation patterns for every plant in the dataset.

5. Retrofit Costs and Construction Costs Sub-Module

This sub-module develops information on the variability in technology retrofit costs as well as CCGT construction costs, which are assumed to be correlated in our model. We model the

variability in costs for the relevant control technologies (wet and dry scrubbers, dry sorbent injection, fabric filters, activated carbon injection, closed cycle cooling, and coal combustion residual compliance costs) and for new CCGTs. The correlations include those for different technologies and the same plant, for the same technology across plants, and for retrofit costs and new construction costs. The vector of all control costs is modeled as multivariate lognormal, mathematically represented as:

Equation 10. Retrofit/control costs model

$$r \sim N(\mu, \Sigma)$$

$$c = e^{r}$$

Where r is a multivariate normal random variable with mean vector μ and covariance matrix Σ, and c is the control/construction cost vector (a vector containing all control/construction costs for all plants). There exists a closed-form expression for the expected value of c as a function of μ. We take the EPA's control costs estimates for different control types and EIA's overnight costs for CCGT as the expected value of c, and back solve for the mean vector μ. No suitable data exists to estimate the covariance matrix Σ. Thus, we create a covariance matrix from a correlation matrix with the following assumed structure. We assume that the correlation between costs for the same control at different plants is 0.6 and the correlation between costs for different controls at different plants is 0.4. We assume that the correlation between costs for all environmental controls and the capital cost of a new CCGT is 0.4. Thus, we assume that costs for the same type of control will be more highly correlated than costs for different types of controls.

In order to create a covariance matrix from this correlation matrix, we also must define a variance vector for the control/construction costs (a vector containing the variances for each control type/plant combination and for CCGT retrofit costs). As described previously for the mean vector, there is a closed-form expression for the variance vector of the normal distribution in terms of the variance vector of the lognormal distribution. Variances are based on the uncertainty ranges given in the Raytheon Coal Unit Environmental Cost Model documentation (which is used by EIA to estimate plant retrofit costs in the NEMS model). In the Raytheon documentation, retrofit costs estimates are given with an uncertainty of ±30%. We assume that standard deviations of the lognormal cost distributions are 15% of the cost, or half of the uncertainty range given by the Raytheon report.

The model takes 100 separate draws of retrofit/construction costs from the multivariate lognormal distribution defined above. The joint variability in costs for retrofits and for new CCGT construction is then used in the retirement decision sub-module, as discussed above.

Appendix C: Energy Market Modeling

This appendix provides details on the National Energy Modeling System (NEMS) as well as our data and methodology for using NEMS to model the potential energy market impacts of the four EPA regulations. This appendix also shows key energy market impact results from NEMS for each year between 2012 and 2020.

A. National Energy Modeling System

This section provides an overview of NEMS and its input categories related to emission controls.

1. Overview

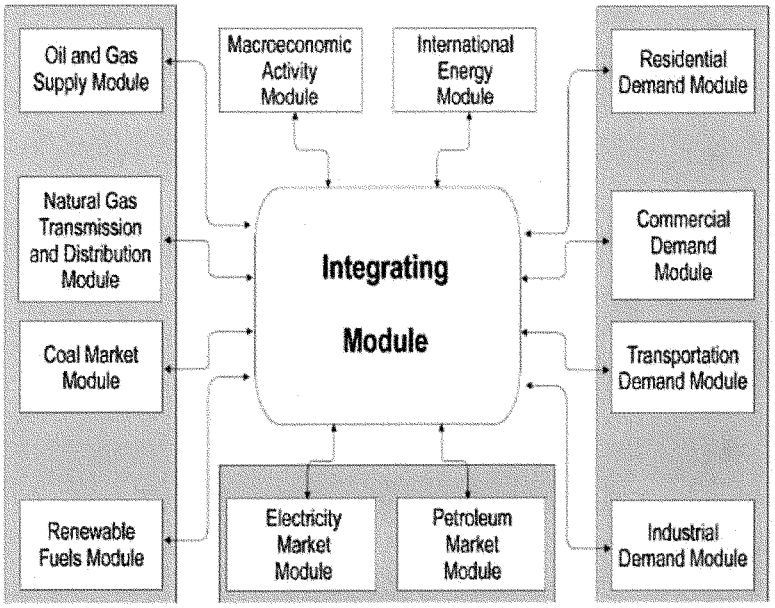
The U.S. Energy Information Administration (EIA) developed and maintains NEMS to produce projections of energy prices and quantities in the long term. EIA also uses NEMS to perform policy analyses in response to requests from Congress, the White House, the Department of Energy, and other government agencies. EIA prepares an *Annual Energy Outlook* (*AEO*) with long-term projections of energy prices and quantities based on current policies and various assumptions. As discussed in Appendix A, our modeling of the potential energy market impacts of the four EPA regulations with NEMS is based on inputs for *AEO 2011* (EIA 2011a); its assumptions are summarized in EIA (2011b).

Figure C-I shows the thirteen modules in NEMS and their linkages. All modules interact via the Integrating Module at the center of the figure. The four modules to the left in the figure (Oil and Gas Supply, Natural Gas Transmission and Distribution, Coal Market, and Renewable Fuels) relate to the supply of primary energy sources. The four modules to the right in the figure (Residential Demand, Commercial Demand, Transportation Demand, and Industrial Demand) relate to the demand for energy. The two modules to the bottom of the figure (Electricity Market and Petroleum Market) convert primary energy sources into electricity and petroleum products. Finally, the two modules to the top of the figure (Macroeconomic Activity and International Energy) provide information from outside U.S. energy systems.

NEMS uses the thirteen modules shown in Figure C-1 to balance energy supply and demand in each region of the United States. In particular, the model calculates the least-cost way to satisfy demand in each region based on the costs of alternative forms of energy and various constraints, including resource availability and energy transportation infrastructure. The level of regional detail in NEMS varies for different forms of energy. For example, NEMS divides the United States into 22 electricity markets, 13 coal production regions, and nine natural gas production regions. Regional detail for energy demand is based on the nine Census divisions.

Additional detail on energy market modeling and NEMS can be found in EIA (2009) and EIA (2011b).

Figure C-1. Overview of NEMS



Source: EIA (2011b, p. 4)

2. Input Categories Related to Emission Controls

NEMS input files include a database of all generation units in the United States as well as parameters that apply uniformly to all units within certain categories. The database includes current and planned scrubber, SCR, and particulate controls for each coal unit in the United States. The database also includes information on some types of environmental control costs for each coal unit. Other types of environmental control costs enter NEMS as parameters that apply uniformly to the relevant coal units.

Table C-1 summarizes unit-specific and uniform inputs related to emission controls. Note that direct sorbent injection (DSI) is not included as an emission control in NEMS, as discussed in Appendix A.

Table C-1. NEMS Inputs Related to Emission Controls

	Miscellaneous	Scrubbers	SCR	ACI	FF	DSI
Unit-specific inputs	- Construction date - Retirement date - Capacity - Capacity factor (historical) - Heat rate - Baseline fixed O&M cost (excluding controls) - Baseline variable O&M cost (excluding controls) - Baseline annual capital cost (excluding controls)	- Current or planned configuration - Capital cost ($/kW) - Emission reduction percentage	- Current or planned configuration - Capital cost ($/kW) - Additional fixed O&M cost - Additional variable O&M cost - Emission reduction percentage	- Current or planned configuration - Emission reduction percentage (based on other controls and coal type)	- Current or planned configuration - Emission reduction percentage (based on other controls and coal type)	- Not in NEMS
Uniform inputs for all coal units		- Capacity penalty - Heat rate penalty - Additional fixed O&M cost - Additional variable O&M cost		- Capital cost ($/kW) - Additional fixed O&M cost - Additional variable O&M cost	- Capital cost ($/kW) - Additional fixed O&M cost	- Not in NEMS

Source: NERA review of NEMS inputs

3. Input Categories Related to CCR and 316(b)

NEMS does not model compliance with CCR or 316(b) policies. As discussed further below, we modeled these policies in NEMS by adding their costs to the unit-specific inputs for general capital costs.

B. Methodology

This section describes NEMS inputs and outputs for modeling the potential energy market impacts of the four EPA regulations.

1. NEMS Inputs

We entered three types of modeling inputs into NEMS: (1) potential emission control costs; (2) coal unit retirements; and (3) compliance measures. This section describes each of these types of inputs.

a. Emission Control Costs

As described in Appendix A, we used EPA estimates for potential emission control costs rather than the EIA assumptions built into NEMS. As summarized above in Table C-1, NEMS incorporates data on the potential costs of environmental controls in case installation of such controls is required. We modified these emission control costs in NEMS for both the reference case and policy case so that costs would consistently reflect EPA cost estimates in both cases. For example, the reference case includes state mercury regulations that would cause some coal units to install ACI and fabric filters. The costs of these ACI and fabric filter retrofits in the reference case reflect EPA cost assumptions, just as they do in the policy case.

To achieve the maximum level of unit-level detail on costs and compliance measures, we used the unit-specific inputs shown in Table C-1 to the maximum extent possible. For emission control costs without unit-specific inputs in NEMS, we used uniform inputs for all units. As shown above in Table C-1, NEMS has unit-specific inputs for scrubber capital costs and SCR capital and O&M costs, so we modified these unit-specific inputs to reflect EPA cost assumptions. Since NEMS only has uniform inputs for scrubber O&M costs and ACI and FF costs, we modified those uniform inputs to reflect EPA cost assumptions. Since NEMS does not model DSI, the variable O&M cost of FF, or the heat rate and capacity penalties of any emissions controls other than scrubbers, we adjusted the relevant unit parameters manually in the unit database. Our modifications for emission control costs are shown below in Table C-2.

Table C-2. Modification of NEMS Emission Control Costs

	Scrubbers	SCR	ACI	FF	DSI
Capital	Assign by unit using NEMS scrubber capital cost input variable	Assign by unit using NEMS SCR capital cost input variable	Assign uniform cost to all units	Assign uniform cost to all units	Assign by unit using NEMS general capital cost input variable
Fixed O&M	Assign uniform cost to all units	Assign by unit using NEMS SCR fixed O&M cost input variable	Assign uniform cost to all units	Assign uniform cost to all units	Assign by unit using NEMS general fixed O&M cost input variable
Variable O&M	Assign uniform cost to all units	Assign by unit using NEMS SCR variable O&M cost input variable	Assign uniform cost to all units	Assign by unit using NEMS general variable O&M cost input variable	Assign by unit using NEMS general variable O&M cost input variable
Heat Rate Penalty	Assign uniform penalty to all units	Assign by unit using NEMS heat rate input variable	Assign by unit using NEMS heat rate input variable	Assign by unit using NEMS heat rate input variable	Assign by unit using NEMS heat rate input variable
Capacity Penalty	Assign uniform penalty to all units	Assign by unit using NEMS capacity input variable	Assign by unit using NEMS capacity input variable	Assign by unit using NEMS capacity input variable	Assign by unit using NEMS capacity input variable

Source: NERA

b. Coal Unit Retirements

As described in Appendix B, we used the Retirement Model to determine which coal units would likely retire rather than incur costs for the four EPA regulations. We also used the Retirement Model for the reference case to determine which coal units would likely retire even in the absence of the four EPA regulations. We entered these retirements into the NEMS database of generation units for the end of 2014 (immediately before compliance with MACT, CCR, and 316(b) is assumed to be required in 2015). We did not allow NEMS to retire coal units based on its own economic evaluations in either the reference case or the policy case.[1]

c. Compliance Measures

The compliance measures that we modeled for CSAPR, MACT, CCR, and 316(b) for the policy case are described in Appendix A. That appendix also describes our modeling of compliance measures for the two most relevant environmental policies in the reference case: CAIR and state mercury regulations. Our methodology and assumptions are summarized briefly here.

We modeled CAIR in the reference case by setting regional emission caps through 2011 in NEMS and allowing NEMS to determine which coal units would need to install environmental controls or fuel switch to lower their SO_2 and NO_x emissions. We modeled state mercury regulations in the reference case by requiring mercury reductions in specific regions in NEMS based on the locations of states with mercury regulations and allowed NEMS to determine which coal units would need to install ACI, fabric filters, and/or scrubbers to comply.

For the policy case, we modeled CSAPR by setting regional caps in NEMS and allowing NEMS to determine which additional coal units would need to install environmental controls or fuel switch to lower their SO_2 and NO_x emissions beyond reductions for CAIR (or for caps without CAIR from 2012 onward). We modeled the MACT mercury standards by requiring mercury reductions based on the standards shown in Appendix A and allowing NEMS to determine which coal units would need to install ACI, fabric filters, and/or scrubbers to comply. We modeled the MACT HCl and PM standards by requiring scrubbers, DSI, and/or fabric filters at particular units, as discussed in detail in Appendix A. Finally, we modeled the CCR and 316(b) regulations in NEMS by applying their unit-specific costs in the NEMS database of generation units using the input variable for general capital costs, since NEMS does not model compliance with non-air emission regulations such as the CCR and 316(b) regulations.

[1] The NEMS model provides less detailed modeling of coal unit retirements than provided for in the retirement model we used. With regard to dispatch, NEMS provides for 216 distinct periods (summer, winter, spring and fall by peak, off-peak and weekend). As with other retirement models (see, e.g., Brattle Group 2010), our retirement model models the full 8,760 hours per year of electricity prices and thus allows for more precise dispatch modeling and forecasts of costs for existing and potential new units. Our model also incorporates uncertainties in key energy price and cost variables and allows the retirement decision to depend upon these uncertainties.

2. NEMS Outputs

Based on the coal unit retirements and the costs of the compliance measures, NEMS calculated the cost-minimizing set of energy prices and quantities. NEMS also endogenously determined the new generation capacity necessary in each electricity region to replace the coal units that would retire. The electricity price results from NEMS include the costs of compliance measures as well as the costs for new generation capacity, among other electricity price components.

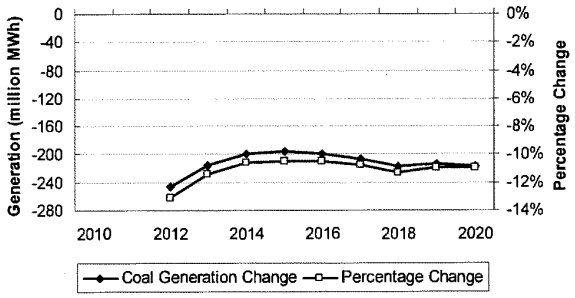
C. Results

This section shows key energy market impact results from NEMS due to the four EPA regulations for each year between 2012 and 2020.

1. Coal-Fired Generation

Figure C-2 shows the change in coal-fired generation between 2012 and 2020 due to the four EPA regulations relative to reference case projections. Coal-fired generation decreases because of the coal unit retirements and the additional costs borne by coal units that do not retire (which make the units less competitive in electricity markets and thus lower their capacity factors). Note that coal units incur costs for their SO_2 and NO_x emissions in the policy case beginning in 2012 due to the introduction of the trading program for CSAPR, with CAIR assumed not to be in place after 2011. In 2015, when many coal units install scrubbers and DSI for MACT HCl compliance, their SO_2 emissions decrease and allowance prices decrease to zero. As a result, coal units have lower costs for SO_2 emissions from 2015 onward than they had from 2012 to 2014. This tends to raise their capacity factors relative to their levels from 2012 to 2014. Coal unit retirements contribute to lower coal-fired generation from 2015 onward.

Figure C-2. Change in Coal-Fired Generation Relative to Reference Case

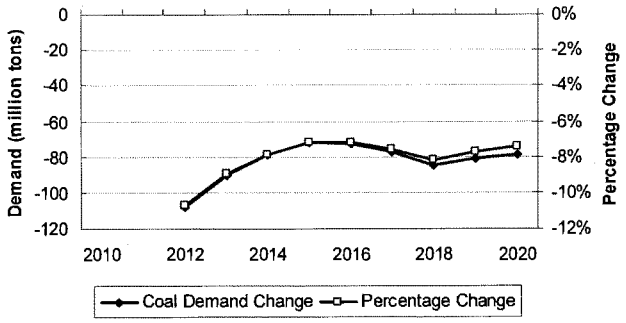


Note: Coal-fired generation in 2010 was 1800 million MWh (EIA 2011a).
Source: NERA calculations as explained in text

2. Electricity Sector Coal Demand

Figure C-3 shows the change in electricity sector coal demand between 2012 and 2020 due to the four EPA regulations relative to reference case projections. Just as for coal-fired generation, electricity sector coal demand decreases because of the coal unit retirements and the additional costs borne by coal units that do not retire (which make the units less competitive in electricity markets and thus lower their capacity factors). The percentage change in electricity sector coal demand is similar to the percentage change in coal-fired generation; the small difference between the percentage changes reflects shifts in the average heat content of coal consumed by units.

Figure C-3. Change in Electricity Sector Coal Demand Relative to Reference Case

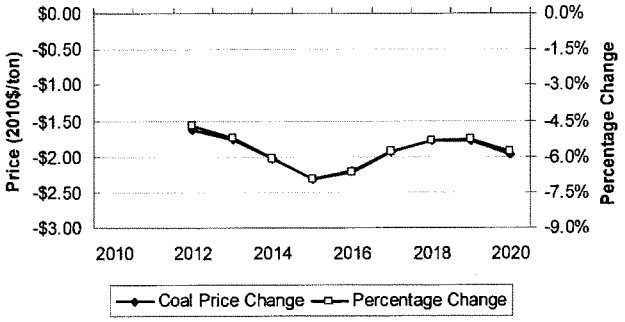


Note: Electricity sector coal demand in 2010 was 1000 million tons (EIA 2011a).
Source: NERA calculations as explained in text

3. Coal Price

Figure C-4 shows the change in average coal minemouth (i.e., wholesale) price between 2012 and 2020 due to the four EPA regulations relative to reference case projections. The price of coal would decrease because of reduced demand for coal by the electricity sector.

Figure C-4. Change in Average Coal Minemouth Price Relative to Reference Case

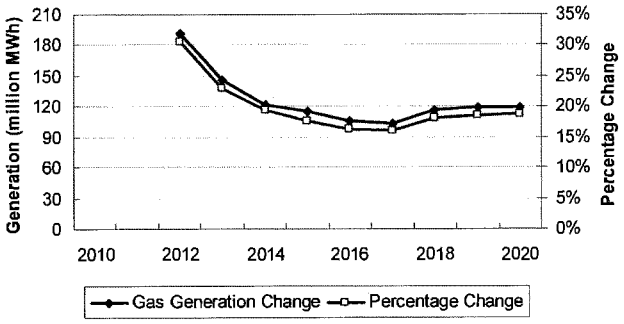


Note: Average coal minemouth price in 2010 was $37/ton (2010$) (EIA 2011a).
Source: NERA calculations as explained in text

4. Natural Gas-Fired Generation

Figure C-5 shows the change in natural gas-fired generation between 2012 and 2020 due to the four EPA regulations relative to reference case projections. When coal units retire and capacity factors for the remaining coal units decrease (due to the costs of environmental controls), the electricity sector shifts toward natural gas. The increase in natural-gas fired generation reflects both new gas units and higher capacity factors for existing gas units. The increase in natural gas-fired generation in each year is somewhat smaller than the decrease in coal-fired generation shown above in Figure C-2 because other energy sources also substitute for coal and total electricity consumption decreases somewhat in response to higher electricity prices (shown below in Figure C-8).

Figure C-5. Change in Natural Gas-Fired Generation Relative to Reference Case

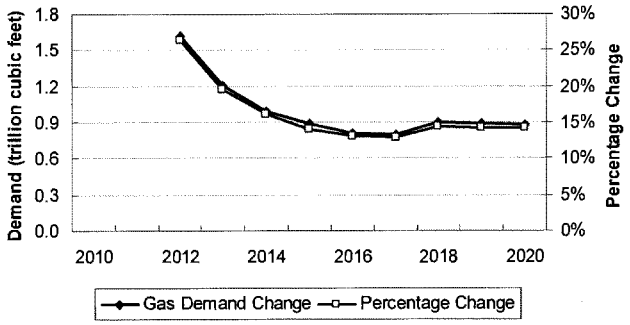


Note: Natural gas-fired generation in 2010 was 750 million MWh (EIA 2011a).
Source: NERA calculations as explained in text

5. Electricity Sector Natural Gas Demand

Figure C-6 shows the change in electricity sector natural gas demand between 2012 and 2020 due to the four EPA regulations relative to reference case projections. Just as for natural gas-fired generation, the increase in electricity sector natural gas demand reflects both new gas units and higher capacity factors for existing gas units. The percentage change in electricity sector natural gas demand in each year is similar to the percentage change in natural gas-fired generation.

Figure C-6. Change in Electricity Sector Natural Gas Demand Relative to Reference Case

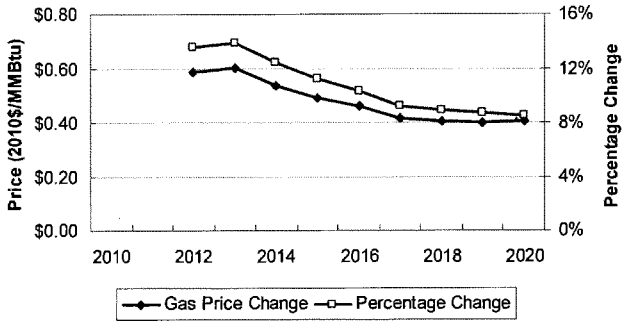


Note: Electricity sector natural gas demand in 2010 was 7.2 trillion cubic feet (EIA 2011a).
Source: NERA calculations as explained in text

6. Natural Gas Price

Figure C-7 shows the change in natural gas price at Henry Hub between 2012 and 2020 due to the four EPA regulations relative to reference case projections. The price of natural gas would increase because of the substantial increase in demand for natural gas by the electricity sector (taking into account the reduction in natural gas demand in other sectors as prices rise).

Figure C-7. Change in Natural Gas Price at Henry Hub Relative to Reference Case



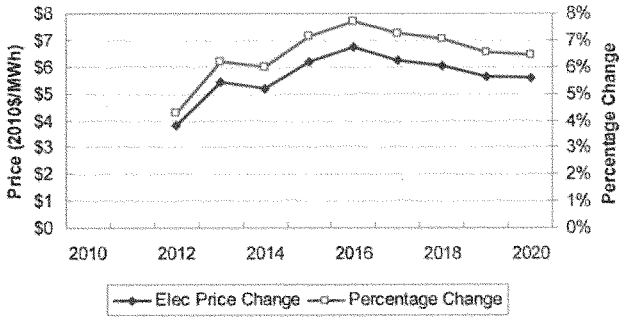
Note: Average natural gas price at Henry Hub in 2010 was $4.50/MMBtu (2010$) (EIA 2011a).
Source: NERA calculations as explained in text

7. Electricity Price

a. U.S. Electricity Price

Figure C-8 shows the change in average U.S. electricity retail price between 2012 and 2020 due to the four EPA regulations relative to reference case projections. The increase in electricity price reflects environmental control costs at coal units that do not retire, SO_2 and NO_x emission costs for CSAPR, construction of new gas units and increased capacity factors for existing gas units, and higher natural gas price.

Figure C-8. Change in Average U.S. Electricity Retail Price Relative to Reference Case

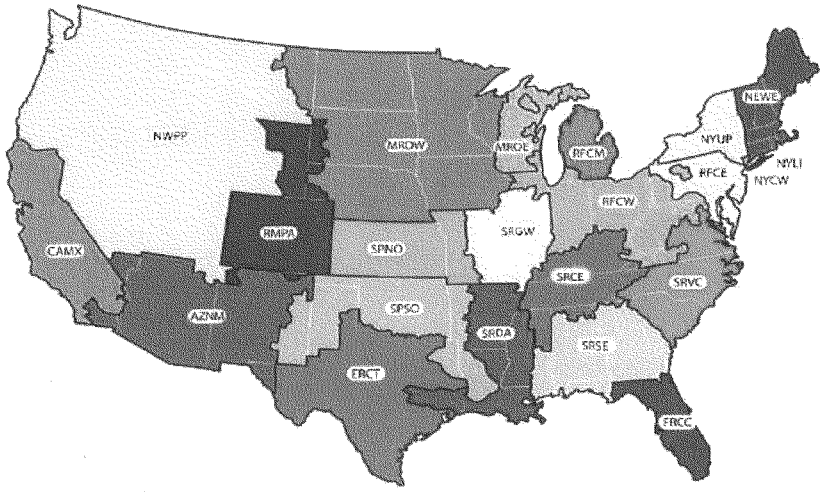


Note: Average U.S. electricity retail price in 2010 was $97/MWh (2010$) (EIA 2011a).
Source: NERA calculations as explained in text

b. Regional Electricity Price

Figure C-9 provides a map of the 22 electricity regions modeled in NEMS.

Figure C-9. NEMS Electricity Regions



Source: EIA (2011b, p. 95)

Table C-3 provides estimates of the electricity retail price impacts in the 22 NEMS electricity regions between 2012 and 2020 due to the four EPA regulations. The impacts reflect different extents to which natural gas prices, coal prices, emission allowance costs, coal unit retirements, and retrofits affect electricity prices in each year in different regions. For example, regions that rely much more on natural gas-fired generation than coal-fired generation (e.g., New England) have larger impacts during 2012-2014 than 2015-2020, because the increase in natural gas prices tapers off over time (see Figure C-7). On the other hand, regions that rely much more on coal-fired generation than natural gas-fired generation (e.g., Kentucky and Tennessee) have smaller impacts during 2012-2014 than 2015-2020, because coal unit retirements and most retrofits occur in 2015.

Table C-3. Regional Electricity Retail Price Impacts, 2012-2020 (2010$/MWh)

		2012	2013	2014	2015	2016	2017	2018	2019	2020	Avg
	US Average	+$3.80	+$5.45	+$5.21	+$6.18	+$6.73	+$6.25	+$6.06	+$5.62	+$5.56	+$5.65
NEMS Regions											
NEWE	New England	+$4.01	+$5.81	+$4.98	+$4.89	+$2.99	+$1.61	+$0.99	+$1.30	-$0.24	+$2.93
NYCW	NYC	+$6.63	+$10.35	+$8.90	+$8.12	+$6.91	+$5.95	+$5.47	+$5.21	+$5.23	+$6.97
NYLI	NY Long Island	+$10.77	+$17.39	+$15.45	+$14.09	+$12.48	+$12.22	+$11.65	+$11.40	+$11.53	+$13.00
NYUP	NY Upstate	+$6.14	+$9.37	+$8.04	+$6.65	+$5.45	+$5.33	+$5.32	+$5.59	+$5.62	+$6.39
RFCE	Mid-Atlantic	+$8.29	+$13.26	+$11.41	+$12.57	+$10.81	+$11.26	+$10.69	+$7.24	+$7.88	+$10.38
SRVC	VA & Carolinas	+$2.63	+$3.71	+$3.71	+$4.13	+$4.91	+$4.72	+$4.41	+$4.13	+$4.06	+$4.05
SRSE	Southeast	+$3.19	+$4.29	+$5.15	+$7.17	+$9.63	+$8.97	+$8.51	+$8.02	+$7.53	+$6.94
FRCC	Florida	+$3.60	+$4.81	+$4.22	+$4.22	+$4.42	+$4.20	+$3.96	+$3.64	+$3.82	+$4.10
RFCM	Lower MI	+$3.70	+$5.41	+$7.10	+$7.31	+$10.00	+$9.51	+$8.83	+$8.46	+$8.35	+$7.63
RFCW	OH, IN, & WV	+$5.42	+$8.65	+$8.08	+$7.18	+$7.12	+$6.85	+$6.59	+$6.48	+$6.70	+$7.01
SRCE	KY & TN	+$4.68	+$4.38	+$5.30	+$9.11	+$11.36	+$10.88	+$10.25	+$9.93	+$9.37	+$8.36
MROE	WI & Upper MI	+$5.63	+$7.78	+$8.12	+$6.57	+$7.37	+$7.14	+$6.79	+$6.54	+$6.66	+$6.96
MROW	Upper Midwest	+$1.41	+$1.11	+$1.23	+$4.90	+$8.36	+$8.20	+$7.94	+$7.85	+$7.54	+$5.39
SRGW	South IL & East MO	+$3.98	+$5.83	+$6.20	+$6.69	+$8.59	+$8.11	+$7.49	+$6.93	+$6.72	+$6.73
SPNO	KS & West MO	+$5.46	+$2.35	+$3.13	+$4.84	+$8.10	+$7.98	+$8.17	+$8.61	+$9.13	+$6.42
SRDA	AR, LA, & West MS	+$2.03	+$3.40	+$4.27	+$5.14	+$6.96	+$6.56	+$6.29	+$5.98	+$5.80	+$5.16
SPSO	Oklahoma	+$3.33	+$7.65	+$8.27	+$8.89	+$11.13	+$10.61	+$9.75	+$9.43	+$9.68	+$8.75
ERCT	Texas	+$4.85	+$7.01	+$6.14	+$9.15	+$6.27	+$3.51	+$4.34	+$3.60	+$3.16	+$5.34
RMPA	CO & East WY	+$0.60	+$0.40	+$0.70	+$1.54	+$2.16	+$1.99	+$1.86	+$1.72	+$1.65	+$1.40
NWPP	Northwest	-$0.14	-$0.30	-$2.27	-$1.22	-$0.07	+$0.38	+$1.20	+$1.40	+$1.36	+$0.04
AZNM	AZ & NM	+$0.82	+$0.70	+$1.04	+$1.39	+$1.71	+$1.69	+$1.56	+$1.86	+$1.85	+$1.40
CAMX	California	+$1.34	+$2.05	+$2.19	+$2.26	+$2.28	+$2.59	+$2.59	+$2.45	+$2.45	+$2.25

Source: NERA calculations as explained in text

Table C-4 shows the percentage changes in electricity retail prices in the 22 NEMS electricity regions relative to reference case projections.

Table C-4. Regional Electricity Retail Price Impacts, 2012-2020 (Percentage Changes)

		2012	2013	2014	2015	2016	2017	2018	2019	2020	Avg
	US Average	+4.3%	+6.2%	+6.0%	+7.1%	+7.7%	+7.2%	+7.0%	+6.5%	+6.5%	+6.5%
NEMS Regions											
NEWE	New England	+2.9%	+4.3%	+3.7%	+3.7%	+2.3%	+1.2%	+0.7%	+1.0%	-0.2%	+2.2%
NYCW	NYC	+3.8%	+6.1%	+5.3%	+4.9%	+4.2%	+3.6%	+3.4%	+3.2%	+3.2%	+4.2%
NYLI	NY Long Island	+6.3%	+10.4%	+9.4%	+8.7%	+7.7%	+7.6%	+7.3%	+7.1%	+7.2%	+8.0%
NYUP	NY Upstate	+5.0%	+7.9%	+6.9%	+5.8%	+4.8%	+4.7%	+4.8%	+5.0%	+5.0%	+5.6%
RFCE	Mid-Atlantic	+8.4%	+13.7%	+11.9%	+13.1%	+11.3%	+11.7%	+11.0%	+7.4%	+7.8%	+10.7%
SRVC	VA & Carolinas	+3.3%	+4.6%	+4.7%	+5.2%	+6.3%	+6.1%	+5.6%	+5.2%	+5.0%	+5.1%
SRSE	Southeast	+3.8%	+5.3%	+6.5%	+9.1%	+11.9%	+10.4%	+9.6%	+8.9%	+8.3%	+8.2%
FRCC	Florida	+3.4%	+4.5%	+4.0%	+4.0%	+4.2%	+4.0%	+3.8%	+3.5%	+3.7%	+3.9%
RFCM	Lower MI	+4.7%	+6.9%	+9.1%	+9.2%	+12.4%	+11.7%	+10.9%	+10.5%	+10.4%	+9.5%
RFCW	OH, IN, & WV	+6.2%	+10.2%	+9.7%	+8.7%	+8.7%	+8.5%	+8.3%	+8.3%	+8.6%	+8.6%
SRCE	KY & TN	+7.2%	+6.9%	+8.5%	+14.7%	+18.6%	+17.9%	+17.0%	+16.5%	+15.5%	+13.6%
MROE	WI & Upper MI	+7.6%	+10.5%	+10.7%	+8.7%	+9.4%	+9.3%	+8.9%	+8.7%	+8.8%	+9.2%
MROW	Upper Midwest	+2.0%	+1.6%	+1.7%	+7.0%	+12.1%	+11.9%	+11.6%	+11.6%	+11.3%	+7.9%
SRGW	South IL & East MO	+6.5%	+9.6%	+10.3%	+11.0%	+14.1%	+13.3%	+12.4%	+11.5%	+11.2%	+11.1%
SPNO	KS & West MO	+6.9%	+2.8%	+3.7%	+5.8%	+9.9%	+9.9%	+10.4%	+11.1%	+12.0%	+8.1%
SRDA	AR, LA, & West MS	+2.7%	+4.6%	+5.9%	+7.1%	+9.9%	+9.4%	+9.0%	+8.7%	+8.4%	+7.3%
SPSO	Oklahoma	+4.7%	+11.1%	+12.0%	+12.8%	+16.0%	+15.3%	+14.1%	+13.6%	+14.0%	+12.6%
ERCT	Texas	+6.4%	+9.4%	+8.3%	+12.2%	+8.1%	+4.4%	+5.5%	+4.5%	+3.9%	+7.0%
RMPA	CO & East WY	+0.7%	+0.4%	+0.8%	+1.7%	+2.4%	+2.2%	+2.1%	+1.9%	+1.9%	+1.6%
NWPP	Northwest	-0.2%	-0.5%	-3.7%	-2.0%	-0.1%	+0.6%	+2.1%	+2.5%	+2.5%	+0.1%
AZNM	AZ & NM	+1.0%	+0.8%	+1.2%	+1.6%	+1.9%	+1.9%	+1.8%	+2.1%	+2.1%	+1.6%
CAMX	California	+0.9%	+1.4%	+1.5%	+1.6%	+1.6%	+1.9%	+1.9%	+1.8%	+1.8%	+1.6%

Source: NERA calculations as explained in text

D. References

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Appendix D: Macroeconomic Modeling

This appendix provides details on the Policy Insight Plus (PI+) macroeconomic model developed and licensed by Regional Economic Models, Inc. (REMI) as well as our data and methodology for using this model to estimate the potential macroeconomic impacts of the EPA regulations.

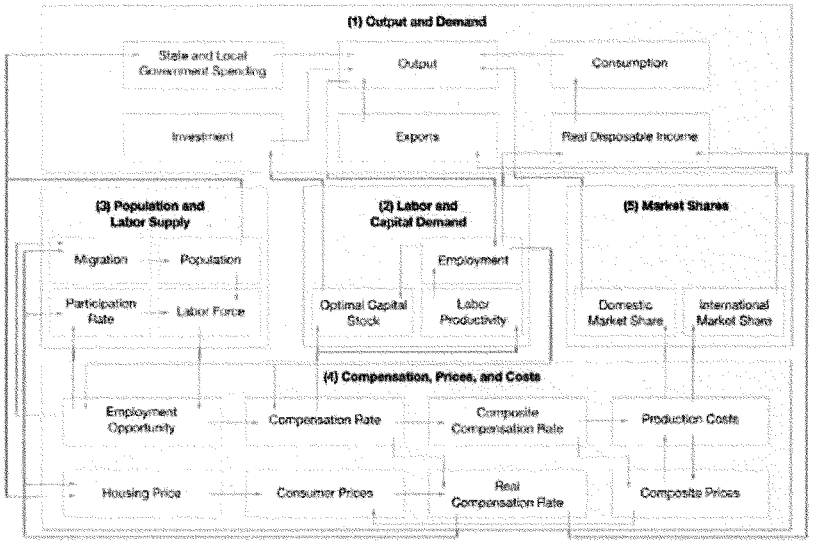
A. Overview of REMI Model[1]

The REMI PI+ model produces estimates of the changes in employment, gross domestic product (GDP), disposable personal income (i.e., personal income after taxes), and other macroeconomic variables due to changes in supply, demand, prices, and other types of inputs. Each version of the REMI PI+ model is custom-built for the regions of interest, which can range from counties to entire countries. The REMI PI+ model incorporates detailed and up-to-date macroeconomic data from the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, the U.S. Census Bureau, and other public sources. The REMI PI+ model is widely used by federal, state, and local agencies, as well as analysts in the private sector and academia, to estimate the effects of regulations, investments, closures, and other scenarios.

Figure D-1 shows the five blocks in the REMI PI+ model and their linkages. The Output and Demand block balances supply and demand for all major sectors of the economy, including both domestic and international sources of supply and demand. The Labor and Capital Demand block models employment and capital stock based on output, wage rates, and capital costs. The Population and Labor Supply block models labor participation rate and population based on wage rates in the various regions and the size of the various sectors. The Compensation, Prices, and Costs block models each sector's production cost, including labor cost based on wage rates. Finally, the Market Shares block uses production cost to model each sector's domestic market share and international market share, which are passed back up to the Output and Demand block.

[1] This section draws on model documentation from Regional Economic Models, Inc. (REMI 2011).

Figure D-1. Key Blocks and Linkages in the REMI Model



Source: REMI (2011)

B. Overview of Methodology

We modeled the potential macroeconomic impacts of the EPA regulations using a 70-sector REMI PI+ model covering the entire United States. The model has regional detail based on Census divisions.

We developed inputs to the REMI model using the energy market modeling results from NEMS for the four EPA regulations.[2] Inputs to the REMI model can take the form of either dollar amounts or percentage changes from the built-in forecasts in the model. We entered all our inputs for this study as dollar amounts measured in constant dollars.

The types of REMI inputs developed from NEMS and other sources are summarized below.

1. *Environmental control costs.* We developed inputs for the positive effects of the capital and operations and maintenance (O&M) costs of environmental controls at the coal units that do not retire. These inputs include the costs of all the projected scrubbers, SCR, ACI, fabric filters, DSI, and compliance measures for the CCR and 316(b) regulations, broken out to the specific model regions in which they are projected to occur. We used the same cost

[2] Details on the energy market modeling results from NEMS are provided in Appendix C.

assumptions as those used in modeling potential coal unit retirements. These capital and O&M costs enter the REMI model as increased demand for machinery manufacturing and construction.

2. *Replacement capacity costs.* We developed REMI inputs for the positive effects of capital costs of new generation capacity to replace the coal units that are projected to retire. Most of the replacement capacity is combined-cycle gas technology. We developed estimates of the capital costs of replacement capacity using energy market modeling results and capital cost assumptions from NEMS. These capital costs enter the REMI model as increased demand for machinery manufacturing and construction.[3] The costs are apportioned to model regions based upon the regions where NEMS has projected the construction of new units will occur.

3. *Coal sales decreases.* We developed REMI inputs reflecting the negative effects of reductions in coal sales. These reductions arise both from coal unit retirements and from the lower capacity factors for coal units that continue to operate but are utilized less because their generation costs are greater due to controls. We developed estimates of reductions in coal sales using regional coal production and mine mouth (i.e., wholesale) price results from NEMS. The NEMS results reflect estimates of changes in coal demand not only in the electricity sector but also in the residential, commercial, and industrial sectors; the changes in these other sectors are small because these other sectors consume very little coal relative to the electricity sector. The values enter the REMI model as decreased sales for the mining sector in the relevant regions.

4. *Coal price decreases.* We developed REMI inputs for the negative impacts of decreases in coal prices on producers due to the decreased demand for coal in the electricity sector. The gains to electricity consumers from the lower coal prices are included below in the estimated effects of changes in electricity prices (which reflect the net effect of compliance costs and changes in fuel costs). In principle, the reductions in coal prices would lead to gains to consumers in non-electric sectors. NEMS does not provide information on coal prices and costs for these sectors that would allow us to assess these potential effects but they would be small because non-electric coal use is a small fraction of utility coal use.[4] We developed estimates of the decreases in coal prices using regional coal production and mine mouth (i.e., wholesale) price results from NEMS. The negative impacts on producers enter the REMI model as decreases in dividend income and government transfer payments (due to the decrease in government tax receipts from lower dividend income taxes).

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[3] The O&M costs of replacement capacity are assumed to be approximately equal to the avoided O&M costs of the coal units that retire. Thus, neither the O&M costs of replacement capacity nor the avoided O&M costs of the coal units that retire are entered into the REMI model, as they would cancel each other out. Since O&M costs of the generating units themselves are small relative to the other inputs to the REMI model, omission of the O&M costs of replacement capacity and coal units that retire does not significantly affect the results of the macroeconomic modeling. In contrast, we do include inputs to reflect the O&M costs of new retrofits as noted above.

[4] The residential, commercial, and industrial sectors collectively accounted for less than 7 percent of total U.S. coal consumption in 2010 (EIA 2011a). Coal price effects for these sectors are considerably smaller than any other effect included in this macroeconomic impact analysis.

5. *Natural gas sales increases.* We developed REMI inputs for the positive impacts of increases in natural gas sales due to the increase in demand from the electricity sector (from new natural gas units replacing the coal units that retire and higher capacity factors for existing gas units). The net increase in natural gas sales, however, is smaller than the increase in electricity demand because the increases in natural gas prices lead to reduced demand from residential, commercial and industrial sectors.[5] We developed estimates of the net increase in natural gas sales using regional natural gas production and wellhead (i.e., wholesale) price results from NEMS. The values enter the REMI model as increased sales for the oil and gas extraction sector.

6. *Natural gas price increases.* We developed REMI inputs for both the positive impacts on natural gas producers of higher natural gas prices (relative to cost increases) and the negative effects of higher natural gas prices on non-utility consumers. (As with coal prices, the negative effects on electric company customers are included in the electricity price impacts.) We developed regional estimates of the increase in natural gas prices using regional natural gas consumption and retail price results for the residential, commercial, and industrial sectors from NEMS. The impacts on consumers enter the REMI model for households as decreases in purchasing power due to increases in natural gas prices and for commercial and industrial sectors as increases in natural gas costs. The impacts on producers enter the REMI model as increases in dividend income and government transfer payments (due to the increase in government tax receipts associated with dividend income taxes).

7. *Electricity price increases.* We developed REMI inputs for the negative impacts of increases in electricity prices on consumers (residential, commercial, and industrial). Because changes in electricity sector costs—for pollution control equipment and fuel price changes—are reflected in electricity prices, electricity producers as a group are not expected to be affected. We developed regional estimates of the increase in electricity prices for consumer groups using regional electricity consumption and retail price results for the residential, commercial, and industrial sectors from NEMS. These values enter the REMI model as increases in electricity price (change in purchasing power) for households and electricity costs for commercial and industrial sectors in the various regions.

8. *Financing of capital costs.* This component arises because the capital costs for pollution control and new capacity are not reflected fully in electricity rates in the years in which they are incurred, although these costs are ultimately reflected in higher electricity rates (as noted above). We developed information on the financing of pollution control and replacement capacity expenditures, in particular the extent to which these capital expenditures would lead to reduced investment or reduced consumption in the years in which the capital expenditures are made, and then increased investment or increased consumption in the years in which

[5] We used the version of REMI that allows for complete fuel substitution for other factor inputs, which assumes that consumers can shift away from more expensive energy and thus reduce the negative impacts of higher natural gas and electricity prices. This assumption may understate the negative imacts of the price increases. We also entered the costs of substitution away from energy into the REMI model as increased demand for energy-efficient appliances. Including this effect may overstate the positive impacts if the REMI model already incorporates these positive adjustments related to substitution away from energy.

electricity price increases reflect these capital costs but the capital expenditures have already been made.

C. Information on Modeling Components

This section provides additional information on the inputs to the REMI modeling. [6]

1. Environmental Control Costs

Environmental control costs consist of the capital and O&M costs for compliance measures at the coal units that do not retire. As discussed in the report body, we assumed that CSAPR would take effect in 2012 and MACT, CCR, and 316(b) would take effect in 2015. The NEMS results reflect compliance in these years, but that model does not incorporate leadtimes for controls. NEMS builds some scrubbers for compliance with the CSAPR SO_2 policy in 2012, and it builds other controls by 2015. We entered the capital costs of controls installed in 2012 into the REMI model as costs in 2012, and we entered the capital costs of controls installed in 2015 into the REMI model as costs spread evenly in 2013, 2014, and 2015 to reflect their leadtime. Costs from 2016 onward primarily reflect the O&M cost of environmental controls. The costs are net of pollution control costs in the reference scenario (which primarily reflect currently planned retrofits by 2012 and mercury controls for state policies in the reference case).

The environmental control costs represent increased demand for manufacturers and construction companies. We reviewed detailed budgets for several retrofit projects in the electricity sector (e.g., PSNH 2010, DOE 2003) and determined that approximately 70 percent of the costs were for equipment and 30 percent for construction. Thus, we modeled 70 percent of the environmental control costs in each year in REMI as increased demand for the machinery manufacturing sector and the remaining 30 percent as increased demand for the construction sector. These environmental control costs are allocated to regions in REMI based on the locations of the coal units incurring the costs.

2. Replacement Electricity Capacity Costs

Replacement capacity costs consist of the capital costs for new electricity capacity (primarily combined-cycle gas units) that NEMS projects will be built, based on its evaluation of supply and demand in regional electricity markets, to replace the coal units that retire.[7] Most of the

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[6] We considered using the optional NEMS macroeconomic activity module to develop the macroeconomic impact estimates but concluded that it would be less appropriate than REMI for this study. The NEMS macroeconomic module uses only changes in energy prices and quantities from NEMS to assess macroeconomic impacts. Thus, the module does not account for the increase in demand for machinery manufacturing and construction or the need to finance the capital expenditures. REMI allows us to incorporate both effects. Moreover, the NEMS macroeconomic module aggregates all energy price changes (including electricity, coal, and natural gas) into a single energy price index for purposes of evaluating macroeconomic impacts. REMI allows us to input separate estimates for the different energy types.

[7] As noted above, neither the O&M costs for replacement capacity nor the avoided O&M costs for coal units that retire are included in the macroeconomic modeling, because they are assumed to be approximately equal in size and therefore would cancel each other out.

replacement capacity is built shortly before 2015 in anticipation of the many coal unit retirements in that year, but some replacement capacity is built later in the modeling period. The assumed capital costs for new capacity are based upon EIA estimates (2011b, p. 97). The replacement capacity costs are net of new capacity costs in the reference scenario. (The four policies pull forward some new capacity that would be built later in the reference scenario.)

The replacement capacity costs represent increased demand for manufacturers and construction companies. Based on our review of electricity sector project budgets (described above), we assumed that 70 percent of the capital costs were for equipment and 30 percent for construction. Thus, we modeled 70 percent of the replacement capacity costs in each year in REMI as increased demand for the machinery manufacturing sector and the remaining 30 percent as increased demand for the construction sector.

NEMS generates estimates of replacement capacity costs for each of its 22 electricity regions, which are based on electric reliability regions defined by the North American Electric Reliability Corporation (NERC). We allocated these values to the regions in the REMI model based upon the shares of baseline generation capacity.

3. Coal Sales Reduction

The coal unit retirements and reduction in capacity factors for non-retiring coal units projected due to the four regulations would lead to decreased demand for coal in the electricity sector. We modeled the reduction in coal sales using regional NEMS results on coal production and minemouth (i.e., wholesale) price. In particular, we calculated the change in coal production in each region and multiplied it by the average of the minemouth prices in the reference case and policy case in each region to capture the quantity effect of the four regulations for coal.[8] We allocated these values to the regions in the REMI model based on the regional data from NEMS. The values enter the REMI model as decreased sales for the mining sector.

4. Coal Price Decreases

This section considers the effects of coal price decreases on producer surplus. As noted above, we did not model coal price effects on consumers because the price effect for the electricity sector is included in the electricity price effects and the price effects for residential, commercial, and industrial sectors are negligible because of their low coal consumption.

The reduction in coal prices due to reduced demand by the electricity sector would reduce producer surplus in the coal sector.[9] We developed REMI inputs for this reduction in producer surplus in the coal sector based on NEMS results by multiplying the change in coal minemouth price (a negative value) by the average of coal productions in the reference and policy cases. We entered the reduction in producer surplus into the REMI model as reductions in dividend income and allocated it across regions based on their share of the U.S. population. Since dividends are

[8] The price effects on consumer and producers surplus are modeled below.

[9] Producer surplus is the amount by which price exceeds marginal cost (or the minimum amount that producers would accept to produce the good), summed over all production. It relates to total profit in a sector.

distributed by companies after paying income taxes, we first multiplied the producer surplus by an estimated effective corporate income tax rate and modeled this change in government corporate income tax receipts as a change in transfer payments. We used an estimated effective corporate income tax rate of 40 percent based on a review of tax rates for energy companies (API 2010, p. 7) and allocated the change in transfer payments across regions based on their share of the U.S. population. We then modeled the remainder of producer surplus as dividend payments.

5. Natural Gas Sales Increase

The new gas units and higher capacity factors for existing gas units due to the four regulations would lead to increased demand for natural gas in the electricity sector. Since higher natural gas prices in the REMI model lead to lower natural gas sales, but the regulations would lead to both higher natural gas prices and higher natural gas sales due to the outward shift of the demand curve for natural gas in the electricity sector, we needed to calibrate the natural gas sales inputs to ensure that the REMI results would be consistent with the NEMS results for natural gas sales. We did this by running the REMI model first with the inputs shown above except the change in natural gas sales, examining the natural gas sales results from the REMI model, and calibrating the natural gas sales inputs to correspond with the values from NEMS. We modeled the increase in natural gas sales using regional NEMS results on natural gas production and wellhead (i.e., wholesale) price. In particular, we calculated the change in natural gas production in each region and multiplied it by the average of the wellhead prices in the reference case and policy case in each region to capture the quantity effect of the four regulations for natural gas. We allocated these values to the regions in the REMI model based on the regional data from NEMS. The values enter the REMI model as increased sales for the oil and gas extraction sector.

6. Natural Gas Price Increases

This section considers the impacts of increases in natural gas prices—due to increased electricity sector demand—on consumers and producers.

a. Impacts on Natural Gas Consumers

The increase in natural gas demand in the electricity sector would increase the price of natural gas for all sectors of the economy. We used regional NEMS results on natural gas consumption and retail prices for the residential, commercial, and industrial sectors to develop REMI inputs for these adverse consumer impacts. NEMS produces these results for the nine Census divisions. We calculated the change in retail natural gas price in each region and multiplied it by the average consumption in the reference and policy cases in each region to capture the price effect of the four regulations for natural gas. We allocated these values to the regions in the REMI model based on their historical shares of natural gas expenditures in their Census divisions. We entered the values for the residential sector in the REMI model as decreased household purchasing power (reflecting the increased natural gas prices), and we entered the values for the commercial and industrial sectors as increased natural gas costs for these sectors.

b. Impacts on Natural Gas Producers

The increase in natural gas prices due to expanded demand by the electricity sector would increase producer surplus in the natural gas sector. As with producer surplus in the coal sector, we modeled the increase in natural gas as increases in dividend payments and government transfer payments, using an effective corporate income tax rate of 40 percent. The change in producer surplus is calculated as the change in wellhead price multiplied by the average production in the reference and policy cases.

7. Electricity Price Increases

The four regulations would lead to increases electricity prices for the residential, commercial, and industrial sectors. We used regional NEMS results on electricity consumption and retail prices for the residential, commercial, and industrial sectors to develop REMI inputs for this type of impact.[10] NEMS produces these results for the nine Census divisions. We calculated the change in retail electricity price in each region and multiplied it by baseline consumption in each region to capture the price effect of the four regulations for electricity. We allocated these values to the regions in the REMI model based on their historical shares of electricity expenditures in their Census divisions. We entered the values for the residential sector in the REMI model as increased electricity price (change in purchasing power) for households, and we entered the values for the commercial and industrial sectors as increased electricity costs for these sectors.

8. Financing of Capital Costs

We presume that electricity companies would finance the net capital cost requirements (capital costs for environmental controls and new capacity minus contemporaneous electricity rate increase due to financing) in each year through debt financing. The impacts on the economy in each year would depend in part upon the extent to which the increased utility demand for capital—primarily from 2012 to 2015, with much smaller investment required from 2016 onward for replacement capacity–would lead to reductions in investment elsewhere in the economy, i.e., crowd out other investment. Since the REMI model does not reflect changes in the overall productivity of the economy due to changes in investment, however, the distinction between changes in investment and changes in consumption as the source of financing is less important.[11]

The extent of crowding out of other investment depends upon the short-run demand and supply elasticities for investment capital as well as on the detailed general equilibrium effects in the overall economy. If the short-run capital supply elasticity is zero, as many researchers have found (see Bernheim 2002), 100 percent of the increased demand by the electricity companies would be reflected in reduced investment elsewhere.

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[10] Note that the changes in retail electricity prices from NEMS reflect the annualized costs of environmental controls and replacement capacity, not the actual expenditures by the electricity sector in each year. This issue is discussed below in the context of financing.

[11] Studies suggest that the general equilibrium economic effects of crowding out productive investment could be substantial. See Schmalensee (1994).

Various studies have considered the specific crowding out of pollution control expenditures. Gray and Shadbegian (2001) find that pollution control expenditures in the pulp and paper sector actually lead to more than a 100 percent reduction in other capital expenditures in the sector when account is taken of reductions at individual plants (188 percent decline) and approximately 100 percent decline considering only capital expenditures at other facilities. Jorgenson and Wilcoxen (1990) in their study of the effects of pollution control expenditures on the U.S. economy use a short-run elasticity for the supply of capital of zero (i.e., perfectly inelastic), implying 100 percent crowding out of investment in the short-term.

One plausible alternative is to assume 100 percent crowding out of private investment, based upon estimates of a zero short-term elasticity of supply of capital and some of the empirical estimates for compliance costs. Since the elasticity of supply may be greater than zero, we assumed crowding out of 50 percent for the net investment years.[12] We presumed that that the other 50 percent of net utility investment would come from additional savings and thus reduced consumption.[13] We presumed that the bondholders would receive additional income in the later years.

The reduced private investment is entered into REMI as reduced investment in residential structures, nonresidential structures, and nonresidential equipment based on their shares of baseline U.S. investment. The change in income for bondholders is entered into the REMI model as changes in consumption.[14]

D. Modeling Results for the Four Environmental Policies

We modeled the potential net macroeconomic impacts of the four regulations by entering all the inputs categories described above into the REMI model. We also calibrated the REMI model to ensure that the net changes in sales for the coal, natural gas, and electricity sectors with all the inputs were consistent with their net changes in sales from NEMS.[15]

---

[12] If the modeling included the negative effects of crowding out productive investment on economic growth, it would be more important to be precise about the specific amount of crowding out of private investment.

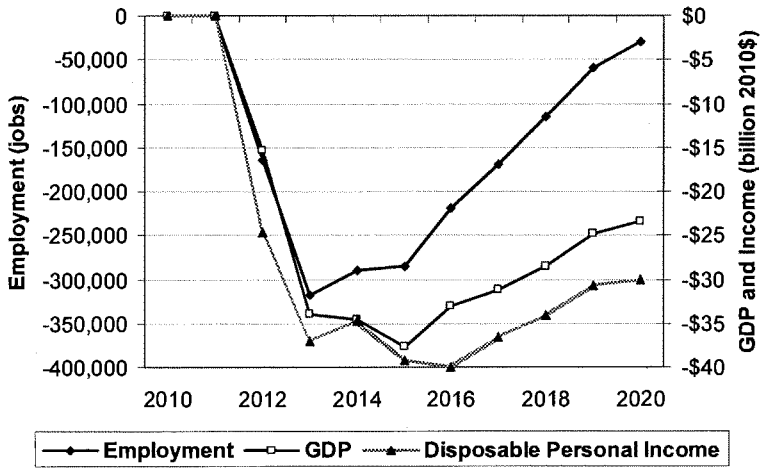
[13] These calculations presume that environmental compliance expenditures do not use unemployed or idle resources. As Schmalensee (1994) points out, there is no reason why tightening environmental regulation would weaken economy-wide forces that produce unemployment and, indeed, that the net short-term impact of tightening environmental standards is likely to increase overall unemployment in the near term in the process of shifting jobs within the economy (with monetary and fiscal policies, changes in exchange rates, changes in foreign economic policies and economic conditions and firm and household expectations being the major factors determining overall macroeconomic conditions).

[14] Entering the change in income alternatively as a change in dividends, interest, and rent would yield very similar results (because REMI indicates that dividends, interest, and rent in any year are mostly used for consumption in that same year).

[15] We performed this calibration by (1) running REMI once with all inputs except changes in sales; (2) calculating the difference between changes in sales from REMI for the coal, natural gas, and electricity sectors and their changes in sales from NEMS; and (3) running REMI again with the difference in sales (in addition to other inputs) so that the sales results from REMI would be consistent with the sales results from NEMS.

Figure D-2 shows the annual impacts of the four environmental policies on U.S. employment, GDP, and disposable personal income from 2012 to 2020 predicted by the REMI model.

Figure D-2. Macroeconomic Modeling Results



Source: NERA calculations as explained in text

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ACCCE

Impacts of Seven EPA Regulations

Impacts	Scenario 1	Scenario 2	Scenario 3
Annual cost (electric sector)	$15.4 B	$15.0 B	$16.7 B
Peak year cost (electric sector)	$37.1 B	$36.1 B	$44.1 B
Total cost (electric sector, 2013 - 2034)	$203 B	$198 B	$220 B
U.S. average employment loss	590,000/yr	887,000/yr	544,000/yr
U.S. peak year employment loss	Over 700,000	2.2 million	Almost 900,000
Peak loss in Upper Midwest	207,000	455,000	236,000
Peak loss in Miss. Valley	159,000	591,000	155,000
Total coal shutdowns	69,000 MW	69,000 MW	54,000 MW
U.S. average income loss per household	$226/yr	$512/yr	$217/yr
U.S. peak year income loss	$415/family	$723/family	$415/family
Peak loss in Upper Midwest	$685/family	$1,300/family	$650/family
Peak loss in Miss. Valley	$654/family	$1,600/family	$644/family

1

EXPLANATION

National Economic Research Associates (NERA) analyzed the impacts of seven EPA regulations that affect coal-fired electricity generation: Mercury and Air Toxics Standards (aka Utility MACT rule), regional haze, national ambient air quality standards (NAAQS) for ozone, SO_2 NAAQS, $PM_{2.5}$ NAAQS, 316(b), and coal combustion residuals. The N_{ew}ERA model was used to conduct the analysis. Many of the economic and cost assumptions are taken directly from EPA's analysis and EIA data.

NERA's analysis involved modeling three scenarios. Scenario 1 uses EPA's annualized costs for a revised ozone standard and assumes the costs are incurred beginning in the year in which compliance is required for each nonattainment area. Scenario 2 assumes that EPA's annualized costs for a revised ozone standard are capitalized and incurred before and during the year in which compliance is required for each nonattainment area. Thus, scenarios 1 and 2 bracket the costs of a revised ozone standard of 65 ppb. Scenario 3 assumes natural gas prices that are similar to EIA's low Estimated Ultimate Recovery (EUR) case, which makes the prices from $0.50/MMBtu to $1.50/MMBtu higher than EIA's AEO 2012 reference case. The analysis is careful to avoid double counting. For example, emission controls installed to comply with one rule are not counted again in determining the cost of complying with another rule that might require the same emission controls. All dollars are reported by NERA in either 2010$ or 2012$. All cumulative impacts, except employment, are present values as of January 2013, calculated at a five percent discount rate.

NERA's analysis does not use worst case assumptions and relies, in most instances, on EIA data and EPA cost estimates. For example, NERA uses EPA costs to model the effects of regulating coal combustion residuals and cooling water intakes (316(b)). Overall, we believe the impacts projected by

NERA are conservative; it is very possible the impacts of these regulations could be more severe than NERA's projections. For example -

- The analysis does not include CSAPR, which has been vacated. If EPA adopts a replacement rule, the impacts projected by NERA could be greater than shown in this analysis.
- The analysis assumes that (1) EPA will regulate coal combustion residuals as non-hazardous waste; (2) EPA will not require the installation of closed cycle cooling at all electric generating facilities; (3) EPA will lower the ozone standard to a level of 65 ppb, rather than a more stringent level; and (4) no further emission reductions from coal-fueled units will be necessary due to EPA's revised SO_2 standard. If EPA adopts regulations that are more stringent than these assumptions (or if the regulations are implemented in a more stringent manner), the impacts will be more severe than NERA's projections.
- The analysis does not include the potential effects of EPA's planned greenhouse gas regulations for existing coal-fired units. EPA has not proposed any such regulations yet but has indicated that it will at some future time.
- The analysis does not consider possible changes to EPA's effluent guidelines for power plant water discharges. EPA has not proposed any changes yet, but is expected to later this year.
- The analysis assumes that all necessary emission controls can be installed by 2016 to comply with MATS without incurring any additional costs due to unusually large demands for labor and materials.
- The modeling does not analyze the potential for electric reliability problems that could be caused by the large number of premature coal unit shutdowns over a short time frame in order to comply with EPA deadlines. Many experts and public officials have raised concerns about electric reliability.

Employment losses caused by the EPA rules take into account the net effect of jobs that are lost (e.g., due to higher energy prices) and jobs that are created (e.g., construction of pollution controls) by these regulations.

Household disposable income is the total amount of money available for spending or saving by a family after taxes have been paid.

The NewERA macroeconomic model includes 11 regions of the U.S. The Upper Midwest region is comprised of Ohio, Michigan, Indiana, Kentucky and West Virginia. The Mississippi Valley region is comprised of Wisconsin, Illinois, Missouri and Arkansas.

October 26, 2012

SUBMITTED BY THE HONORABLE CHARLES MCCONNELL

ACCCE
AMERICAN COALITION FOR CLEAN COAL ELECTRICITY

IMPACT OF EPA REGULATIONS

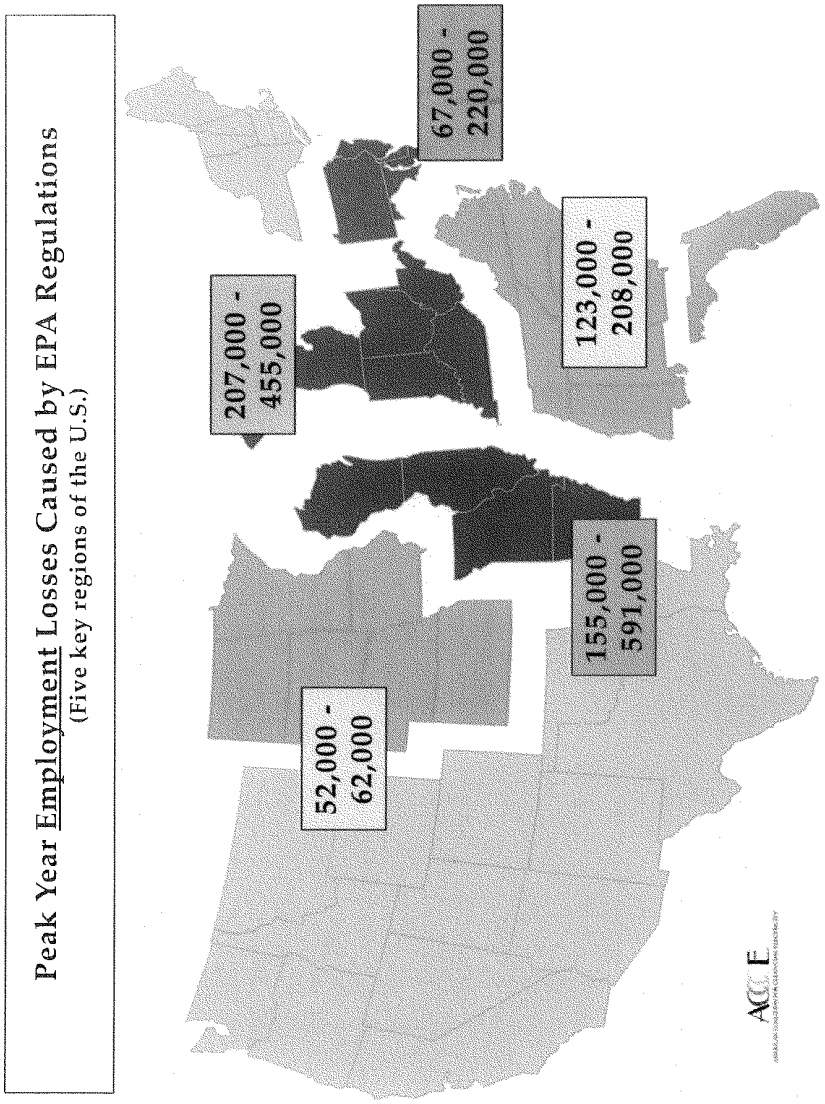
National Economic Research Associates (NERA) analyzed the impacts of seven EPA regulations that affect coal-fueled electricity generation: MATS, regional haze, ozone NAAQS, SO_2 NAAQS, $PM_{2.5}$ NAAQS, 316(b) and coal combustion residuals. The analysis evaluates three scenarios: two make different assumptions about the timing of ozone compliance costs; the third assumes slightly higher natural gas prices than current projections. The projected economic impacts for all three scenarios are substantial. NERA's analysis does not use "worst case" assumptions. These are some of the highlights of the analysis:

- ✓ Compliance costs for the electric sector total $198 billion to $220 billion and average $15.0 billion/year to $16.7 billion/year. Peak year compliance costs total $36 billion to $44 billion.
- ✓ Coal shutdowns are projected to total 54,000 MW to 69,000 MW, most of which are due to the EPA regulations.
- ✓ U.S. employment losses average 344,000/year to 887,000/year. Peak year employment losses are 700,000 to 2.2 million.
- ✓ Peak year employment losses range from 354,000 to more than 1 million in regions of the country that include Ohio, Michigan, Missouri, Wisconsin, Illinois and Indiana.
- ✓ The average nationwide loss in disposable income varies from more than $200/household to over $500/household. Peak year loss in family income is over $400/household to more than $700/household.
- ✓ Peak year loss in family income ranges from $644/household to $1,600/household in regions of the country that include Ohio, Michigan, Missouri, Wisconsin, Illinois and Indiana.

NERA's 129-page report, *Economic Implications of Recent and Anticipated EPA Regulations Affecting the Electricity Sector*, provides details on the scenarios, assumptions and other impacts. The report is available at www.cleancoalusa.org.

October 26, 2012

SUBMITTED BY THE HONORABLE CHARLES MCCONNELL



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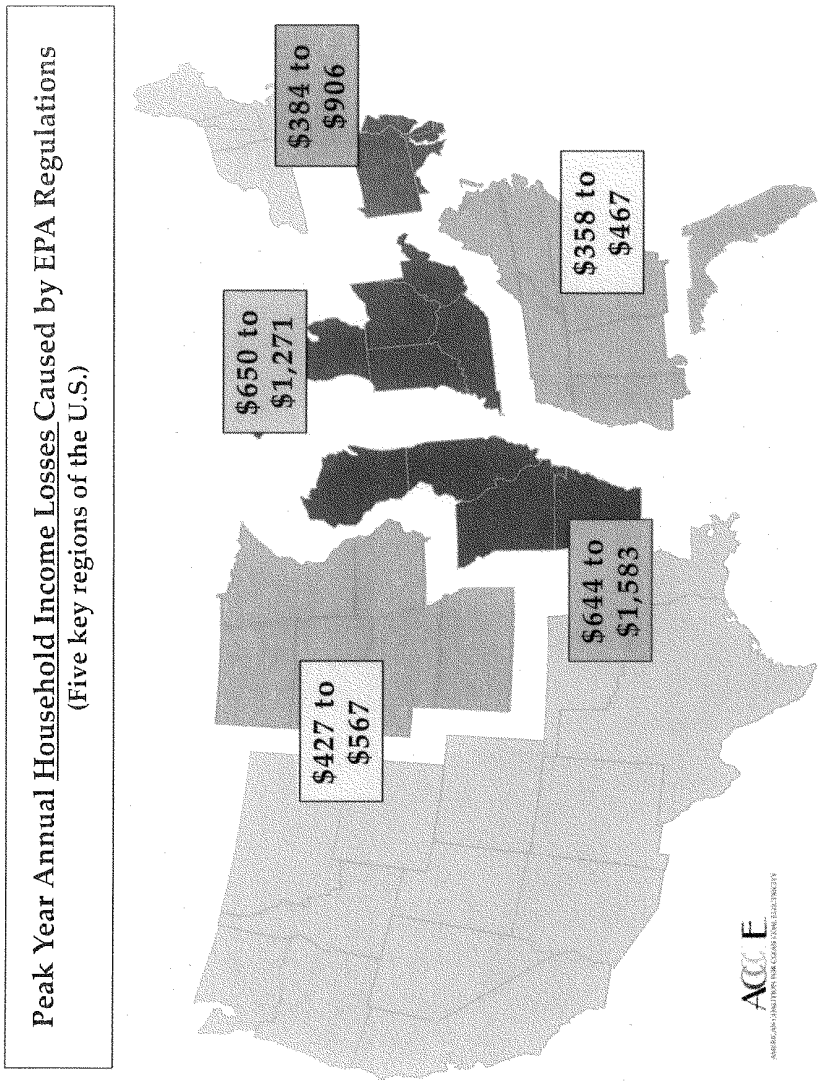

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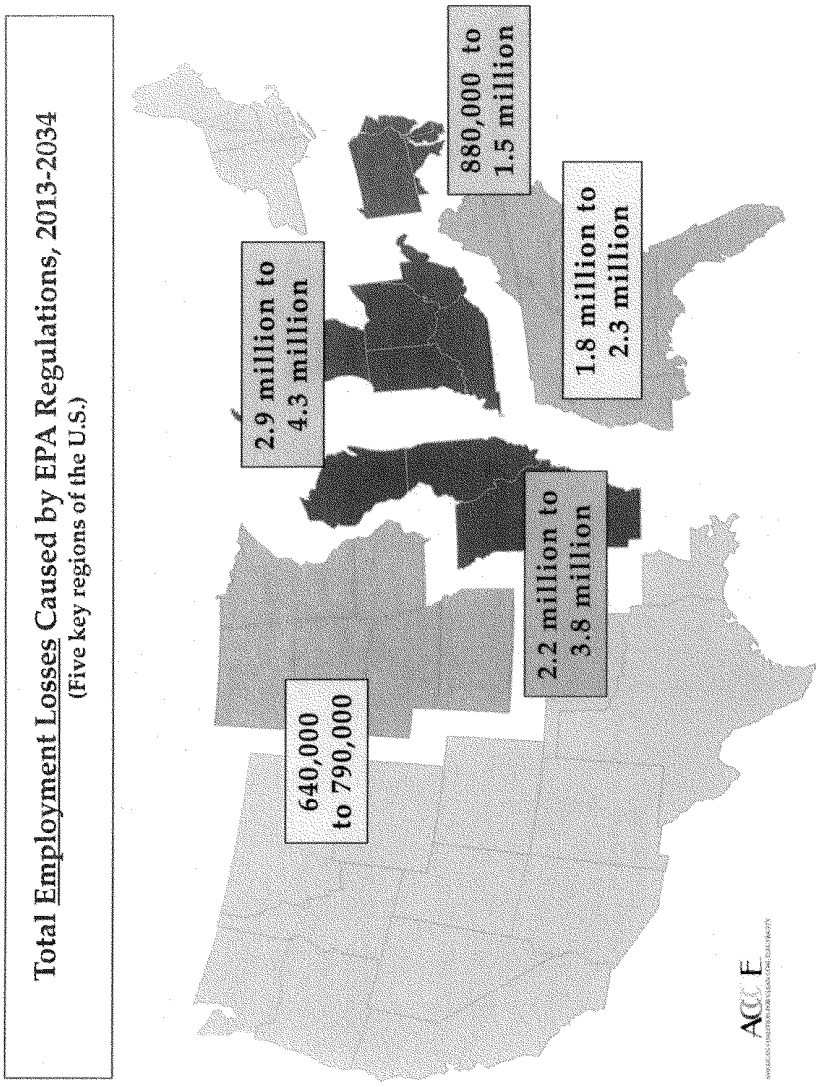

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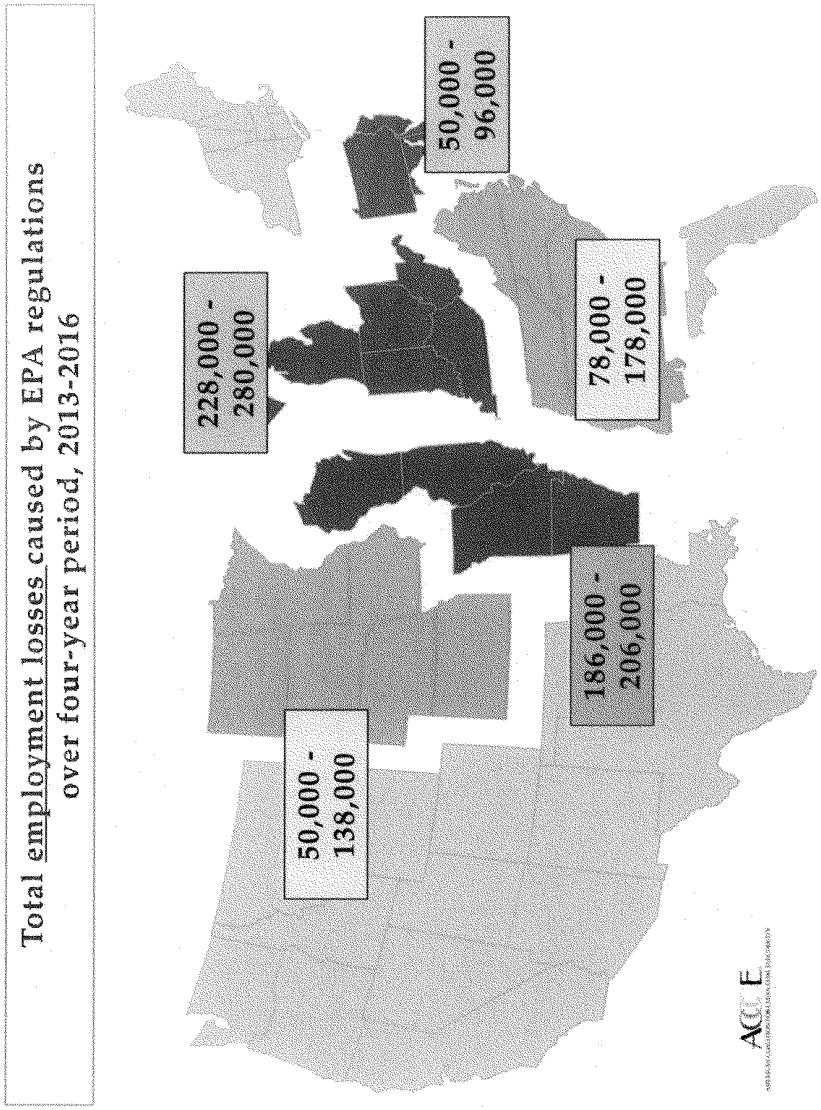

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Congress of the United States
House of Representatives

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Subcommittee on Environment
and
Subcommittee on Energy

Science of Capture and Storage: Understanding EPA's Carbon Rules

Wednesday, March 12, 2014
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

Panel 1

David Hawkins, Director of Climate Change Programs, Natural Resources Defense Council

Robert G. Hilton, Vice President, Power Technologies for Government Affairs, Alstom Power Inc.

Robert C. Trautz, Senior Technical Leader, Electric Power Research Institute

Scott Miller, General Manager and CEO, City Utilities of Springfield Missouri, American Public Power Association

Panel 2

Janet McCabe, Acting Assistant Administrator, Office of Air and Radiation, U.S. Environmental Protection Agency

NATURAL RESOURCES DEFENSE COUNCIL

Comments on

Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units

77 Fed. Reg. 22,392 (April 13, 2012)

Comments on Measures Needed to Assure the Integrity of Carbon Capture and Storage in the Power Plant New Source Performance Standards

submitted by

Natural Resources Defense Council

June 25, 2012

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I. Introduction

We thank the Environmental Protection Agency (EPA) for the opportunity to comment on the proposed carbon pollution standards for new power plants. These comments are directed to requirements needed to assure the integrity of carbon capture and storage (sequestration) as a compliance option under the rule.

The Natural Resources Defense Council (NRDC) is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and online activists nationwide, served from offices in New York, Washington D.C., San Francisco, Los Angeles, Chicago and Beijing.

II. Treatment of CCS under the proposed rule's compliance obligations

(1) General discussion

The proposed rule defines CCS as follows: "Carbon capture and storage (CCS) means a process that includes capture and compression of CO_2 produced by an electric utility generating unit before release to the atmosphere; transport of the captured CO_2 (usually in pipelines); and storage of that CO2 in geologic formations, such as deep saline formations, oil and gas reservoirs, and unmineable coal seams".[1] The proposed rule clearly lists CCS as a compliance option and lists specific standards to be met by the EGU in the case that CCS is used towards compliance.[2]

We submit that EPA's standards must include provisions to address the risk of CO_2 leakage after CO_2 captured at the plant site leaves the site to be transported to, and disposed of in, a sequestration facility. To this end, the standards need to include (directly or by reference) requirements that captured CO_2 must be transported through approved pipelines to approved sequestration sites, where both the pipelines and sequestration sites are subject to appropriate requirements for preventing emissions, and for monitoring, quantifying, and reporting to detect and correct any such emissions. The standards must specify that an EGU source may subtract captured CO_2 from its reported CO_2 emissions only if these provisions are complied with.

CCS systems necessarily involve equipment and facilities beyond the EGU plant site. It would be utterly unacceptable for an EGU to capture CO_2 and pipe it off-site, only to have it released from the open end of a pipe across the fence-line. Thus, at a minimum, an EGU must not be allowed to deduct captured CO_2 from its emissions unless it has, and complies with, an

[1] 77 Fed. Reg. 22439.
[2] 77 Fed. Reg. 22436-22437.

enforceable commitment to ship that CO_2 by a pipeline operating in compliance with containment, monitoring, and reporting requirements, to a sequestration facility that in turn operates in compliance with containment, monitoring, and reporting requirements.

Accordingly, unless the owners and operators of the receiving pipelines and sequestration facilities are subject to obligations to monitor and report CO2 emissions and are subject to noncompliance penalties no less stringent than those applicable to covered NSPS facilities under the Clean Air Act, any release from such pipelines and sequestration facilities of CO2 produced by a covered EGU must be attributed to the covered EGU for NSPS compliance purposes.

Further, EPA needs to adopt, directly in this rule or by reference, appropriate and specific standards for containing, monitoring, quantifying and reporting emissions from pipelines and sequestration facilities. Only upon compliance with such requirements shall the EGU be allowed to deduct sequestered CO_2 from its own emissions.

(2) EPA's Greenhouse Gas Reporting Rule and compliance with the proposed rule

With appropriate improvements, the CCS-related requirements of EPA's Greenhouse Gas Reporting Rule could form the basis of the provisions needed in the standards to set forth the compliance obligations of EGU sources that employ CCS systems. While EPA has adopted a general Greenhouse Gas Reporting Rule, that rule is not adequate on its own to assure compliance with the NSPS for EGUs. We address some of the needed improvements below.

Subparts UU and RR of the Greenhouse Gas Reporting Rule apply to facilities that inject and geologically sequester CO_2 respectively.

We do not consider reporting under subpart UU to be sufficient to assure compliance with the proposed NSPS, given that it amounts to no more than reporting meter readings and does not consider the potential for emissions from sequestration sites. EPA should not accept reporting under subpart UU of the Greenhouse Gas Reporting Rule by itself as sufficient for the purposes of compliance of CCS facilities under the proposed rule.

Subpart RR applies to facilities that geologically sequester CO_2 and includes additional obligations over subpart RR to identify CO_2 leakage pathways (including likelihood, magnitude and timing), delineate the monitoring area, identify a strategy for detecting and quantifying any surface leakage of CO_2, and identify a strategy for establishing expected baselines for monitoring CO_2 surface leakage.

However, reporting under subpart RR is not mandatory for all CO_2 injection facilities – only for wells that inject CO2 under Class VI of the Underground Injection Control Program (UIC). Furthermore, compliance with subpart RR by itself does not guarantee that adequate standards are met in order to satisfy the higher level of compliance requirements that are needed to effectively enforce the proposed rule, for several reasons. First, the requirements under

subpart RR are general, and could be implemented very differently depending on the discretion of the Administrator. Second, Monitoring, Reporting and Verification (MRV) plans are reviewed on an individual basis and are not made public until finalized, with only an ex-post option for appeal to the Environmental Appeals Board for interested parties. Third, reporting under subpart RR does not require or guarantee that geologic sequestration sites are sited, operated and decommissioned in a way that will aim to prevent or minimize leaks to the atmosphere. The requirement is merely to report any emissions.

For these reasons, EPA should not accept reporting under subpart RR of the Greenhouse Gas Reporting Rule by itself as sufficient for the purposes of compliance of CCS facilities under the proposed rule. The informational and general nature of the Reporting Rule renders it unsuitable by itself for compliance with the proposed rule.

(3) UIC well classes and compliance with the proposed rule

We do believe that reporting under subpart RR could be used for compliance under the NSPS if combined with other EPA regulatory requirements. In particular, we believe that EGUs should be allowed to subtract from their on-site atmospheric emissions quantities of CO_2 that are being injected and sequestered (minus any leaks) in wells permitted under UIC Class VI (which makes reporting under subpart RR compulsory). However, we do not believe that the same should be allowed if CO_2 is being injected in Class II wells.

Class II dates back several decades and is used for injecting brines, CO_2 and other fluids associated with oil and gas production, and hydrocarbons for storage.[3] Class VI is a new injection well class, which was designed specifically for and applies to wells that inject CO_2 for geologic sequestration.[4] Class VI rules are far more recent than Class II rules, and were promulgated in December 2010.

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[3] 40CFR144.6(b) defines Class II wells as "[w]ells which inject fluids:
(1) Which are brought to the surface in connection with natural gas storage operations, or conventional oil or natural gas production and may be commingled with waste waters from gas plants which are an integral part of production operations, unless those waters are classified as a hazardous waste at the time of injection.
(2) For enhanced recovery of oil or natural gas; and
(3) For storage of hydrocarbons which are liquid at standard temperature and pressure.

[4] 40CFR 144.6(f) defines Class VI wells as "[w]ells that are not experimental in nature that are used for geologic sequestration of carbon dioxide beneath the lowermost formation containing a USDW; or, wells used for geologic sequestration of carbon dioxide that have been granted a waiver of the injection depth requirements pursuant to requirements at §146.95 of this chapter; or, wells used for geologic sequestration of carbon dioxide that have received an expansion to the areal extent of an existing Class II enhanced oil recovery or enhanced gas recovery aquifer exemption pursuant to §§146.4 of this chapter and 144.7(d)."

Regulatory requirements for Class VI are more comprehensive than for Class II on many counts. Below we summarize some key differences:

- The information than needs to be submitted at the time of a permit application is more extensive under Class VI. For example, key geological, geomechanical, lithological and geochemical properties of the confining zone, information on faults or fractures that may interfere with confinement, seismic history, and information on wells with the area of review have to be submitted under a Class VI permit application. Class II does not have such requirements, or requires only information on known wells that is of public record rather than the use of methods to discover orphaned or abandoned wells.
- Class VI siting requirements include an injection zone with sufficient properties to receive the total anticipated volume of CO_2 injectate, a confining zone big enough to contain injected *and* displaced fluids, and with sufficient integrity to allow injection without initiating or propagating fractures. Class II requires only a confining zone that is free of transmissive faults and fractures.
- Monitoring requirements for Class II are limited to analyzing injected fluids with sufficient frequency to yield data representative of its chemical and physical characteristics, as well as injection rate, pressure and volume measurements. Class VI requirements include an extensive testing and monitoring plan that covers operational parameters for the well, direct and indirect methods to track the extent of the CO_2 plume and the area of elevated pressure, water quality measurements, as well as surface monitoring if required by the Director.
- Class VI requirements for a well plugging plan are tailored to individual situations rather than requiring off-the-shelf methods to be used.
- Class II lacks any post-injection site care and site closure requirements. Class VI requires post-injection monitoring for fifty years, or an alternative period if it can be shown that it is sufficient, in order to establish the evolution of the injected CO_2 and displaced fluids, and that no USDWs are being endangered. Once no endangerment established, then the Director may authorize site closure, at which point financial responsibility obligations cease.
- The area of review and corrective action requirements for Class VI are broader. The actual area of review does not rely on default distances, needs to be updated at least every five years, requires modeling of certain specifications to determine the extent of the CO_2 plume and displaced fluids, and more extensive identification of penetrations within the area of review. A revision of the area of review also may require revision of other required plans.
- Financial responsibility obligations under Class VI are more comprehensive than under Class II.

40CFR146.81(d) states that "Geologic sequestration means the long-term containment of a gaseous, liquid, or supercritical carbon dioxide stream in subsurface geologic formations. This term does not apply to carbon dioxide capture or transport."

- Class VI emergency and remedial response provisions require actions by the owner or operator to address movement of the injection or formation fluids that may cause an endangerment to a USDW during construction, operation, and post-injection site care periods. Class II has no such requirements.
- Construction requirements, as well as requirements for logging, sampling and testing, go further in Class VI than they do in Class II.
- The standard for granting primacy to states for the implementation of the program is weaker for Class II wells, and consists of a general effectiveness demonstration as opposed to meeting individual stringency and adequacy criteria.

Class VI therefore contains comprehensive requirements tailored to geologic sequestration projects that aim to ensure that CO_2 does not contaminate groundwater. Preventing groundwater contamination serves the purpose of reducing the likelihood that injected CO_2 will enter the atmosphere. On the other hand, injection under Class II permits combined with reporting under subpart RR could leave substantial gaps in terms of safeguards for effective sequestration of CO_2, which would seriously compromise compliance under the proposed rule.

EPA should allow EGUs to show compliance with the standards of the proposed rule by subtracting from their atmospheric emissions CO_2 that is being injected and sequestered (minus any leaks) in wells permitted under UIC Class VI and that report their emissions under subpart RR.

Further, EPA should consider establishing a compliance demonstration pathway for sequestration facilities that are not covered by Class VI permits.

We believe that EPA should propose and finalize requirements to classify carbon dioxide that is captured and injected during enhanced hydrocarbon recovery operations as geologically sequestered if it determines that conditions for site selection, operation, mitigation, remediation, monitoring, reporting and abandonment are met that will ensure minimum risk of, and appropriate response to, potential leakage from the intended carbon dioxide confinement zone.

EPA regulations establishing requirements for qualifying carbon dioxide injected in Enhanced Hydrocarbon Recovery operations as geologic sequestration should include but not be limited to the following:

- A demonstration that sites are capable of long-term containment of carbon dioxide;
- Identification and characterization of potential natural and man-made leakage pathways, and appropriate risk management and corrective actions;
- Design, construction and operation parameters to prevent, mitigate and remediate the creation or activation of leakage pathways, or and the migration of CO_2 or fluids into any zone in a manner not authorized by the Administrator (or pursuant to a State program approved by the Administrator as meeting the requirements of these regulations);

- Minimizing fugitive CO_2 emissions from project operations;
- Monitoring and modeling to predict and confirm the position and behavior of the CO2 and other fluids in the subsurface during and after injection;
- Accounting and reporting of CO_2 quantities sequestered, injected, recycled, leaked, vented, and any other categories as appropriate; and,
- Post-injection site closure and financial responsibility requirements that ensure the long-term containment of injected CO_2.

Pending the promulgation or revision of such regulations by EPA, the Agency should approve applications for qualification of carbon dioxide injected in Enhanced Hydrocarbon Recovery operations as geologically sequestered for the purposes of the proposed rule pursuant to guidelines that conform to the requirements above.

(4) Carbon Capture and Storage Needs to be Further Defined to Assure Permanent Sequestration

As noted above, EPA needs to refine the definition of carbon capture and storage to assure permanent sequestration. We suggest that EPA add the word "permanent" to the proposed definition of CCS:

> Carbon capture and storage (CCS) means a process that includes capture and compression of CO2 produced by an electric utility generating unit before release to the atmosphere; transport of the captured CO2 (usually in pipelines); and *permanent* storage of that CO2 in geologic formations, such as deep saline formations, oil and gas reservoirs, and unmineable coal seams.

Further, EPA should define geologic sequestration consistently with its Safe Drinking Water Act regulations to mean the permanent containment of a gaseous, liquid, or supercritical carbon dioxide stream injected in subsurface geologic formations that are shown to have the suitable characteristics necessary to provide such containment, under operating and abandonment conditions, and requirements designed to ensure and verify such containment, as determined by the Administrator.

III. Conclusion

We thank EPA for the opportunity to comment on the proposed rule. NRDC continues to believe strongly that geologic sequestration of CO2, correctly implemented, must be a component of the U.S. climate mitigation portfolio. However, the proposed carbon pollution standards for new power plants must ensure that the technology is deployed safely and effectively, and must not create a precedent whereby emitters are allowed to treat carbon dioxide that is captured, transported and sequestered without the appropriate safeguards that will ensure that it is not emitted to the atmosphere and that it does not endanger human health or the environment.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENVIRONMENT
SUBCOMMITTEE ON ENERGY

HEARING CHARTER

Science of Capture and Storage: Understanding EPA's Carbon Rules

Wednesday, March 12, 2014
10:00 a.m. – 12:30 p.m.
2318 Rayburn House Office Building

PURPOSE

The Subcommittees on Environment and Energy will hold a joint hearing entitled *"Science of Capture and Storage: Understanding EPA's Carbon Rules"* on Wednesday, March 12th, at 10:00 a.m. in Room 2318 of the Rayburn House Office Building. This hearing will explore the basis for the Environmental Protection Agency's (EPA) conclusion that carbon capture and storage systems (CCS) are adequately demonstrated as a technology for controlling carbon dioxide emissions in full-scale commercial power plants. Technical experts will focus on the potential use of CCS in both coal and natural gas fired power plants and the challenges associated with long-term geologic sequestration of carbon dioxide. The hearing will examine the EPA's rationale in proposing New Source Performance Standards (NSPS) for commercial power plants.

WITNESS LIST

Panel 1

- **David Hawkins,** Director of Climate Change Programs, Natural Resources Defense Council
- **Robert G. Hilton**, Vice President, Power Technologies for Government Affairs, Alstom Power Inc.
- **Robert C. Trautz**, Senior Technical Leader, Electric Power Research Institute
- **Scott Miller**, General Manager and CEO, City Utilities of Springfield Missouri, American Public Power Association

Panel 2

- **Janet McCabe,** Acting Assistant Administrator, Office of Air and Radiation, U.S. Environmental Protection Agency

BACKGROUND

Regulatory Context:

Section 111 of the Clean Air Act (CAA) establishes a unique technology-based mechanism for controlling emissions from stationary sources. Section 111(b) provides EPA authority to promulgate performance standards which apply to new and modified sources. Specifically, EPA is directed to set standards based on "the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."[1] In setting the standard EPA is given some flexibility in that "emission limits may be established either for equipment within a facility or for an entire facility."[2]

Southern's Kemper Project in Progress: "The Kemper plant will use two commercial-scale TRIG™ units to gasify lignite (low-rank coal that is mined next to the facility) to produce syngas. After the syngas leaves the gasifiers, it will be cleaned and used as fuel for two combined-cycle power generating units with a net output of 582-megawatts of electricity." *Global CCS Institute Status of CCS.*

EPA first proposed a New Source Performance Standards (NSPS) for emissions for carbon dioxide (CO2) from power plants in 2012. However, after more than 2.5 million comments on the original proposal, EPA decided that a new approach was warranted and rescinded the original proposal.[3]

Simultaneously, on September 20, 2013 Administrator Gina McCarthy announced EPA's re-proposed CO2 NSPS for new fossil fuel-based electric generating units (EGUs), explaining, "These proposed standards reflect separate determinations of the best system of emission reduction (BSER) adequately demonstrated for utility boilers and IGCC units and for natural gas-fired stationary combustion turbines."[4]

Under the proposal, EPA concluded that CCS has been adequately demonstrated as a technology for controlling CO2 emissions in full-scale commercial applications at coal-fired EGUs, while reaching the opposite conclusion—that CCS is not adequately demonstrated—in the case of gas-fired EGUs. Based on this determination, EPA proposed an emissions limit for coal-fired sources of 1,100 lbs of CO2 per mega-Watt-Hour (MWH) and proposed standards for natural gas combined cycle sources

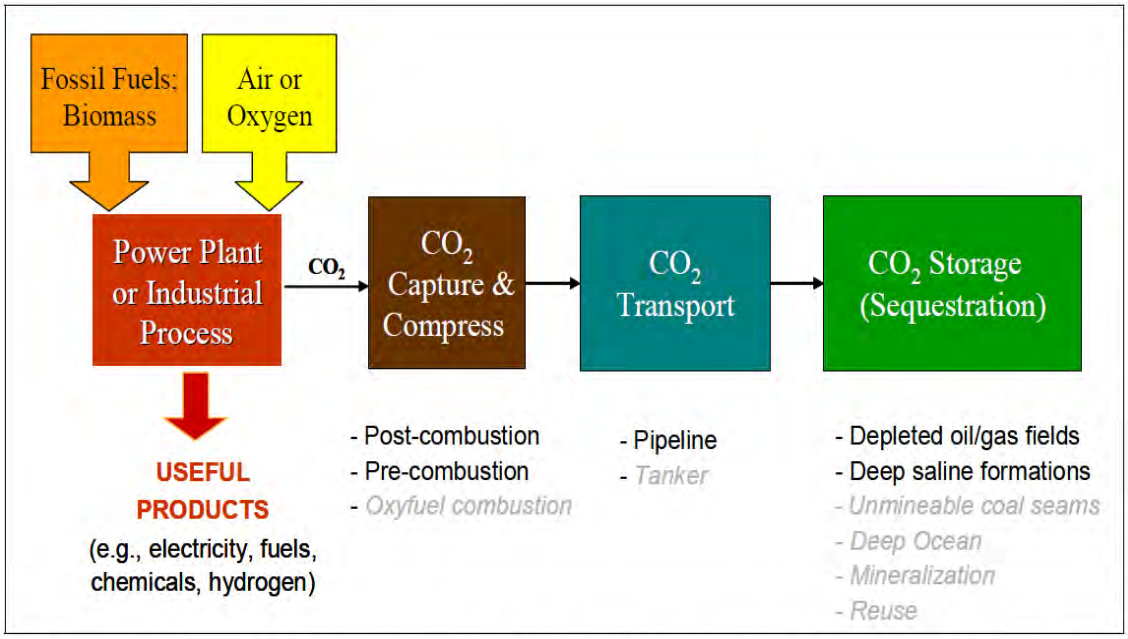
[1] Clean Air Act § 111(a)(1), 42 USCA § 7411(a)(1) (2006).
[2] http://www2.epa.gov/sites/production/files/2013-09/documents/111background.pdf
[3] Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, Proposed Rule, Preamble p. 14-5, Sep. 20, 2013.
[4] *Id.* at 15.

from 1,000 to 1,100 lbs CO2/MWH depending on the size and type of unit.[5] Electric Generating Units that primarily fire biomass are exempted from the proposed rule.[6]

In examining the regulatory impact, EPA asserted that "coal units built between now and 2020 would have CCS, even in the absence of this rule." In light of this modeling, "EPA projects that this proposed rule will result in negligible CO2 emissions changes, quantified benefits, and costs by 2022."[7] EPA sought comment for its proposal.

Technical Background:

Carbon capture and storage (CCS) methods capture CO2 from fossil fuel combustion before it is released into the atmosphere and store it underground in geological formations. Unlike some emission control devices, CCS is not simply one piece of technology; it requires a system of coordinating elements for successful implementation. Broadly speaking, there are four links in the CCS chain: capture, compression, transportation, and storage. Each link in the chain poses separate and distinct technology challenges. Among these components, capture is the most technology-intensive and costly. Storage, on the other hand, poses the greatest liability and regulatory obstacles.



Source: E. S. Rubin, "Will Carbon Capture and Storage be Available in Time?" Proc. *AAAS Annual Meeting, San Diego, CA, 18-22 February 2010*, American Academy for the Advancement of Science, Washington, DC.

In the NSPS proposal, EPA notes four projects that—with significant governmental financial assistance—are designed to use some type of capture technology. Although none of these projects have been completed, EPA anticipates at least one of these demonstration projects

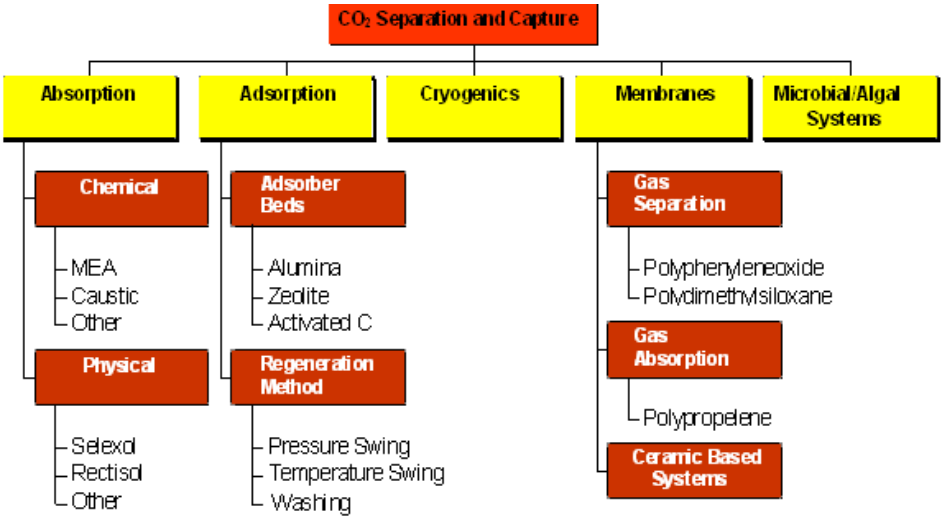
[5] *Id.* at 15-6.
[6] *Id.* at 30, fn. 8.
[7] *Id.* at 16-7.

will be operational in the near future. EPA cites Southern Company's Kemper County Energy Facility in Mississippi (pictured on p. 2), SaskPower's Boundry Dam CCS Project in Canada, The Texas Clean Energy Project in Odessa, and Hydrogen Energy California, LLC. Each of these projects, when completed, will utilize some elements of the CCS system EPA has selected in this proposal.

However, despite the promise of CCS technologies in power systems, currently there are no electric power plants operating with the CCS technology on a commercial scale.

Capture

CO2 capture may be achieved through pre-combustion, post-combustion, or oxy-combustion technologies. **Pre-combustion** removal methods typically require the high-concentration of CO2 associated with expensive gasification systems. **Post-combustion**, on the other hand, utilizes nitrogen-based solvents to scrub the CO2 from the flue gas. However, because post-combustion capture requires substantial heat input to release the CO2 and regenerate the solvent, it results in significant reductions in overall plant efficiency and a substantial increase in cost. A third process, **oxy combustion**, requires expensive and energy intensive air separation units. While oxy systems hold promise, they are more experimental. Overall, while capture technologies exist, the new challenges associated with operating at a larger scale will not become clear until after full-scale deployment.



Source: A.B. Rao and E.S. Rubin, "A Technical, Economic and Environmental Assessment of Amine-Based CO2 Capture Technology for Power Plant Greenhouse Gas Control," *Environmental Science & Technology.* *(See CRS Report 41325, p. 10.)*

Compression & Transport

Once the CO2 is captured, it must be compressed. As with capture, compression is an energy-intensive process. After compression, transportation to a storage site is required. Although dedicated CO2 pipelines have potential, technical challenges remain to ensure safe and reliable transport. Given the numerous policy and legal issues related to siting, permitting, and environmental requirements, creation of a full-scale CO2 pipeline infrastructure requires substantial capital investment and further regulatory development.[8]

[8] CONGRESSIONAL RESEARCH SERVICE, *Legal Issues Associated with the Development of Carbon Dioxide Sequestration Technology*. Feb. 8, 2011. Available at: http://www.crs.gov/pdfloader/RL34307.

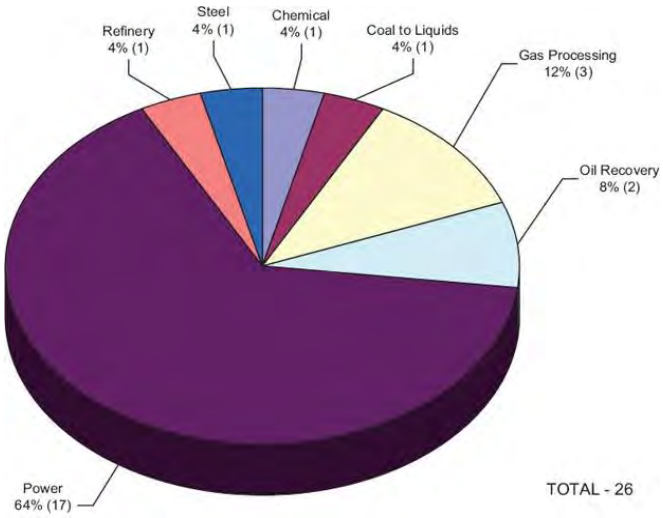
"To date, there are no commercial ventures in the United States that capture, transport, and inject large quantities of CO2 (e.g., 1 million tons per year or more) solely for the purposes of carbon sequestration." *CRS Report 42496, p. 24, Feb 10, 2014.*

Storage

The final step in a CCS system is storage. However, permanently storing emissions is highly dependent on neighboring geology to the power plant. Geological storage is potentially available in deep saline formations, depleted oil fields, un-mineable coal seams, or for enhanced oil or gas recovery (EOR). However, lessons learned from failed storage sites in Africa demonstrate that maps of promising geologic formations do not always equate to locations where carbon storage should occur. Consequently, unresolved issues related to property rights acquisition, pore space management, regulatory structure, environmental protection issues, and liability remain a challenge. Significantly, EPA is unable to release operators from liability and litigation risk if a problem occurs in storing the CO2.[9]

Because of these challenges and the potential to offset the significant cost of CCS, the proposed rule focuses on the use of the captured CO2 for enhanced oil recovery (EOR). EOR has been used as a way to increase production in depleted oil fields by injecting CO2 and pumping previously unrecoverable oil to surface. While EOR provides outstanding opportunities to increase oil production in some regions, many locations do not have access to an EOR market. Absent a robust EOR market, CO2 would simply be stored geologically. Some have questioned whether EOR operators would be able to meet new reporting requirements contained in the NSPS proposal.[10]

According to the Global CCS Institute's 2013 report, 64% of the 26 <u>cancelled or delayed</u> projects are in power generation.



Future of CCS Demand:

As discussions of new climate strategies continue, pressure for additional CO2 restrictions will likely increase. Simultaneously, worldwide energy demand, particularly in emerging economies, is growing rapidly. Much of the current and future demand for energy will

[9] CONGRESSIONAL RESEARCH SERVICE, *Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy*. Feb. 10, 2014. Available at: http://www.crs.gov/pdfloader/R42496.

[10] Philip M. Marston. GLOBAL CCS INSTITUTE. *A CO_2-EOR regulatory update from the US*. Feb. 17, 2014. Available at: http://www.globalccsinstitute.com/insights/authors/philipmarston/ 2014/02/17/co2-eor-regulatory-update-us.

continue to be supplied by fossil fuels. Consequently, projections suggest a strong long-term need for affordable technologies that can supply low-carbon energy from fossil fuels.[11]

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[11] *See e.g.*, U.S. ENERGY INFORMATION ADMINISTRATION, *International Energy Outlook 2013: With Projections to 2040*. Available at: http://www.eia.gov/forecasts/ieo/pdf/0484(2013).pdf.

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U.S. ENVIRONMENTAL PROTECTION AGENCY, *Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units*. 40 CFR Part 60. Sep. 20, 2013. Available at: http://www2.epa.gov/carbon-pollution-standards/2013-proposed-carbon-pollution-standard-new-power-plants.

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
CHAIRMAN LAMAR SMITH

For Immediate Release
March 12, 2014

Media Contacts: Zachary Kurz
(202) 225-6371

Statement of Environment Subcommittee Chairman David Schweikert (R-Ariz.)
Hearing on Science of Capture and Storage: Understanding EPA's Carbon Rules

Chairman Schweikert: I want to thank the witnesses for being here today. Your expertise is invaluable in helping this committee understand the practical and sometimes negative and damaging effects of EPA rulemaking. We are here to learn the facts about carbon capture and storage. And more specifically, we are here to see whether those facts support what EPA has proposed.

When I look at the EPA's new source performance standardsproposal, I'm reminded of the Air Force's plans to develop a nuclear powered plane. That's right—a nuclear powered plane! They called it Project Pluto or "The Flying Crowbar."

Americans knew the power of atomic weaponry and military tools. The components had been tested. We had jet planes and nuclear reactors.

But something happened in moving from a dream to reality. The reality was that nuclear power worked, but only under specific controlled conditions, and in limited applications. And with a lot of supervision, testing and well trained staff.

Of course in hind sight, we understand that "Project Pluto's" nuclear powered aircraft would have been a disaster—and we luckily avoided that. We never built a fleet of "Flying Crowbars." In this way, Carbon Capture Storage is similar. It might work under specific conditions, but not everywhere. And we have no reason to believe it will work at the scale EPA is expecting us to believe.

This Administration has made no secret that it is an enemy to affordable fossil fuels, including coal. From what I have witnessed it appears the Administration would rather see carbon capture and storage fail altogether

It was candidate Obama who famously said that if you want to build a coal plant you can – it's just that it will bankrupt you. With this rule it looks like the President is keeping that old campaign promise—to bankrupt coal. But at least they are being upfront about CCS for coal power. What's more troubling is what's hinted at but left unsaid. I want to know what this rule will really do, not just today but five, ten, twenty years down the road.

While the Administration likes to tout the economic benefits the natural gas revolution is bringing us, they are simultaneously attacking this affordable and renewable energy source. Likewise, this rule is at odds with the Administration's claimed goal: addressing global CO2 concentrations. The EPA's rule on carbon capture and storage would actually halt CCS research and development.

These rules are simply a thinly veiled attempt to prevent new coal power and eventually take down natural gas.

Does the EPA think Americans cannot see past their empty rhetoric? There are towns and communities all across this nation that want this administration to uphold their all of the above energy strategy.

But even if environmental extremists could prevent American's from enjoying reliable and affordable fossil fuels, developing countries have no intention of giving up fossil fuels. So an EPA rule that derails carbon capture and storage development will be disastrous.

Here's the bottom line: The Administration's rhetoric is disingenuous at best.

America is long overdue for a frank conversation about the future of our domestic energy solutions. No more hiding-the-ball. Let's take a step back from the end-of-the-world-scenarios—on both sides. Gather the facts. And have an honest discussion about the consequences of our policy choices. EPA's new source performance standards rule requires something that doesn't exist yet—full-scale power with at least 40% carbon capture and storage.

The Agency largely justifies the proposal on an assumption that captured CO2 will be used in enhanced oil recovery (EOR) operations.

The EPA has touted that the sale of CO2 would help offset the incredible costs of the capture side of CCS systems. But EPA's new source performance standards for power plants require full scale power with at least forty perfect carbon capture systems. In addition, the standards add new requirements to enhanced oil recovery options that effectively remove it as a compliance option.

These Oil Recovery operators can't comply, leaving power plants with no option but geologic sequestration. But permanent geologic sequestration has serious, unresolved scientific, legal, and regulatory problems.

This rule twists the clear language of the Clean Air Act and allows the EPA to require energy producers to use unproven technology. It sets up obstacles to compliance that undercut the very technology it claims to promote. This isn't about climate change. It's about expanding Federal power and it sets a dangerous precedent.

Let's have a discussion that plays this rule out to its logical conclusion. Then we can consider if that's a place we want to go as a nation.

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Opening Statement

Ranking Member Suzanne Bonamici
Subcommittee on Environment

Joint Subcommittee on Environment and Subcommittee on Energy
"Science of Capture and Storage: Understanding EPA's Carbon Rules"

March 12, 2014

Thank you, Mr. Chairman, and thanks to the Chair of the Energy Subcommittee, Ms. Lummis, for holding this morning's hearing.

Today we will discuss the performance standards proposed by the Environmental Protection Agency (EPA) for carbon dioxide emitted from new power plants. This hearing is similar to a hearing we held last fall, but this time we have the opportunity to hear directly from EPA on this important issue. I'd like to thank Acting Assistant Administrator Janet McCabe for being here today. I'd also like to thank the witnesses on our first panel for their thoughtful testimony.

Last year, President Obama laid out his agenda to address one of the biggest environmental challenges of our time–climate change. A key component of that plan, and any effort to reduce the amount of carbon emitted by the United States, is the need to significantly lower the amount of carbon produced during electricity generation. Emissions from power plants represent about one-third of the greenhouse gases produced by the United States, and EPA's proposed rule takes an important first step in tackling this major source of carbon pollution.

To emphasize - the proposed rule sets carbon limits on new power plants, not existing plants or those under construction. Looking at current and future market conditions, especially competitive natural gas prices, it is likely that many if not most new power plants will be able to meet the proposed carbon limits. It's the market, not the proposed rule, that is contributing to the proliferation of natural gas power plants over coal. In my home state of Oregon, our last coal plant is scheduled to be closed by 2020, and some of that generation capacity will be replaced with a natural gas plant.

The proposed EPA rule will create a market incentive for the continued development and promotion of carbon capture and storage, or CCS, technologies. The advancement of CCS technologies is essential if new coal power plants are to operate in the low carbon future we must achieve.
I also want to point out that when EPA determines the "best system of emission reduction," it is actually legally required to promote the development of technology. I am sure we will hear much more on the state of CCS technologies from today's witnesses. That technology development is good for the economy and the earth.

Last week, we debated the EPA's proposed carbon limits on the House floor. Some called into question whether CCS was "adequately demonstrated" because the technology is not commercially available. There is a difference between the two. The legal requirement is "adequately demonstrated," and the EPA has met that burden.

Let me close by saying that I know many of my colleagues across the aisle are skeptical about whether humans contribute to climate change. But the scientists, overwhelmingly, are not. And my constituents are not, and indeed they are seeing the impacts of climate change now and asking policymakers to act. This winter's reduced snowpack not only means a shorter ski-season and less of

an economic boost from tourism, but it means less water for agriculture and salmon migration this spring and summer. The acidity of the Pacific Ocean is increasing, putting Oregon's fisheries and shellfish industries at risk. Warmer temperatures are leading to increased outbreaks of the mountain pine beetle, harming the Northwest's forest industry. Warmer temperatures are making it more challenging to grow our region's famous Pinot Noir grapes.

The impacts are real and we must do all that we can to mitigate the effects of climate change. The carbon dioxide we release now will affect generations to come. I am supportive of the Administration's efforts to transition the United States to a low carbon economy. The EPA's proposed rule for new power plants is a critical step in that direction.

Thank you and I yield back.

Opening Statement

Ranking Member Eric Swalwell
Subcommittee on Energy
House Committee on Science, Space, and Technology

Joint Hearing of the Environment and Energy Subcommittees
"Science of Capture and Storage: Understanding: EPA's Carbon Rules"

March 12, 2014

Thank you Chairman Stewart and Chairman Lummis for holding this hearing, and I also want to thank the witnesses for their testimony and for being here today.

Global climate change is one of the greatest challenges that we face. Last September, the Intergovernmental Panel on Climate Change released a report which states with 95 percent certainty that human activities are responsible for climate change. This report was based on a rigorous review of thousands of scientific papers published by over 800 of the world's top scientists. The report also makes it clear that if we don't take steps to halt this change, the repercussions for humans and the environment will be catastrophic. We now need to move forward and take the necessary steps to combat the warming of our planet before these impacts become inevitable.

We know that humans are impacting the climate in a number of ways – through emissions from the vehicles we drive, deforestation, and changes in agricultural practices among other things. But electricity generation is the biggest producer of greenhouse gasses, accounting for roughly a third of our total emissions.

I have repeatedly said that I am for an "all of the above" approach to energy production as we transition to clean energy technologies. But I have also made it clear that, as part of this "all of the above" approach, we must take steps to ensure that we are reducing greenhouse gas emissions and lessening their impact on human health, the environment, and the global climate. That is exactly what the proposed standards for new coal and natural gas burning plants aim to do, which is why I support their implementation. And, like Ms. Bonamici, I want to reinforce that these are only proposed standards for any **new** plants that may be built and will have **no** effect on existing plants, so we aren't going to see a wave of shuttered plants and massive layoffs as a result of their implementation. There are in-depth discussions underway about establishing standards for existing plants, which the EPA currently plans to propose in June, and there is ongoing, extensive engagement with all stakeholders to make sure that those standards will be flexible and won't have negative effects on state economies and job creation.

It has been my hope that Congress would act on this issue immediately. Unfortunately, too many of my colleagues choose to ignore the scientific consensus that human beings are playing a significant role in the warming of our planet, so I'm not expecting that much will be done legislatively to sufficiently address this issue anytime soon. The President has made it clear that, in the absence of Congressional action, his Administration is going to take the lead in efforts to

reduce greenhouse gas emissions. These proposed standards reflect that commitment, and I fully support the President in this effort.

My colleagues on the other side of the aisle often say that our children and grandchildren are going to be left holding the bag if we don't reduce our deficits and the national debt, and I agree that it would be irresponsible of us not to take serious steps to put our fiscal house in order. Similarly, future generations will be the ones who will suffer if we don't take immediate and meaningful steps to confront climate change, and in this case – as the global scientific community has made clear again and again – the consequences of our inaction could be far more severe.

With that I yield back the balance of my time.

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
CHAIRMAN LAMAR SMITH

For Immediate Release
March 12, 2014

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Statement of Energy Subcommittee Chairman Cynthia Lummis (R-Wyo.)
Hearing on Science of Capture and Storage: Understanding EPA's Carbon Rules

Chairman Lummis: Thank you Chairman Schweikert. I want to congratulate you on your new position on the committee and look forward to continuing our work through environment and energy subcommittee joint hearings this year.

Last fall, the Science Committee held a similar hearing on the status of technology for Carbon Capture and Storage. It was confirmed that CCS is not operating in any commercial scale power plant in the U.S. and thus should not be considered adequately demonstrated technology under EPA's New Source Performance Standards (NSPS).

Today we will also discuss the transportation and storage of captured carbon and what viable solutions currently exist for industry. I look forward to hearing from the EPA witness on the storage options under the proposed NSPS. Is recycling carbon in enhanced oil recovery (EOR) possible on a large scale or will untested long-term geological sequestration be needed?

The EPA has implied that the rule does not need to speak to the issue of sequestration – that the cost and feasibly of carbon storage is outside the scope of their rulemaking. Staying silent on the last steps of the process proves the lack of demonstrated commercial viability.

Instead of focusing or real solutions, the EPA assumes "this proposed rule will result in negligible CO2 emissions changes, quantified benefits, and costs by 2022." Since it effectively bans the building of new coal plants, it has no impact.

The EPA is ignoring the consequences of their rulemaking to instead set a legal precedent for mandating unproven technologies. They need to go back and assess the impacts of this rule on non-air issues – there is no science behind the "de facto" mandated storage requirement.

This is a policy of picking winners and losers through environmental regulations. New natural gas fired units, boilers and heaters and existing plant standards are next. We need to see an all-of-the-above energy policy, not one based purely on politics.

I look forward to hearing from this first panel of witnesses on the larger effects of this rulemaking to the energy supply chain – from research to delivery. Thank you for joining us.

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Opening Statement

Ranking Member Eddie Bernice Johnson
House Committee on Science, Space, and Technology

Joint Subcommittee on Environment and Subcommittee on Energy
"*Science of Capture and Storage: Understanding EPA's Carbon Rules*"

March 12, 2014

Thank you Mr. Chairman. I am pleased that we will be able to hear testimony on this very important topic, and I want to thank the witnesses for appearing before us today.

Our climate is changing. These changes are resulting in more extreme weather, rising sea levels, and altered food webs. We must accept these new climate realities and be open to solutions if we are at all serious about protecting the health of American families. So I am happy to join my colleagues Ms. Bonamici and Mr. Swalwell in expressing my approval of the steps being taken by the Administration and by EPA, to advance clean energy technologies and protect future generations from the harmful effects of carbon pollution.

Throughout history industry has often resisted addressing environmental problems that emerge from a greater scientific understanding of how human activities impact the environment and our health. And in many of these cases, industry simply refuses to act without regulatory intervention and proper government oversight. The technology which we are discussing today, carbon capture and storage, or CCS technology, is an example of the type of innovative solutions that will not be implemented without a regulatory incentive to lower the amount carbon being emitted.

I, like many of my colleagues, wish that Congress would enact legislation to address climate change. Unfortunately, the current political realities will not allow us to act. So I say let us not stand in the way of EPA and necessary change. Let the Administration continue to move us forward, so that the U.S. can be a leader and we as Americans can do what we always do - rise to the challenge and move with great purpose to solve this crisis. I challenge industry to be leaders, and be a helpful partner in reducing our carbon emissions going forward.

I look forward to the testimony of our witnesses. Thank you again, and I yield back the balance of my time.

BEFORE

the

SUBCOMMITTEE ON ENVIRONMENT
AND THE SUBCOMMITEE ON ENERGY

of the

HOUSE COMMITTEE ON SCIENCE,
SPACE AND TECHNOLOGY

on

EPA'S PROPOSED NEW SOURCE PERFORMANCE STANDARDS FOR CARBON DIOXIDE FOR ELECTRIC GENERATING UNITS

TESTIMONY
OF
DAVID G. HAWKINS,

DIRECTOR, CLIMATE PROGRAMS,
NATURAL RESOURCES DEFENSE COUNCIL

MARCH 12, 2014

Summary

The United States and other large carbon-polluting nations urgently need to take sensible steps to create an affordable, reliable energy system that is compatible with protecting the climate.

The Clean Air Act, passed by Congress more than 40 years ago, allows EPA to set reasonable standards that can cut harmful carbon pollution. EPA has already adopted successful carbon pollution standards from cars and trucks, the second largest source of U.S. carbon pollution.

EPA has proposed standards for new coal plants that are based on carbon capture technology, which has been proven through use on other large industrial categories. Partial carbon capture can easily achieve EPA's proposed standard with costs that are within the range of alternative investments for new plant owners who may be considering options other than natural gas combined-cycle plants.

Carbon capture systems have three components, each of which has been operated in large-scale commercial use for decades: separation of carbon dioxide (CO2) from industrial gas streams; compression and transport of captured CO2 by pipeline; injection of compressed CO2 into geologic formations capable of retaining the gas until it has been converted through natural processes into a harmless mineral. EPA's assessment of the technical feasibility and economic reasonableness of the proposed standards rests on ample evidence and is fully consistent with the requirements of the laws Congress has written and the courts' interpretation of those laws.

Efforts to block EPA's sensible carbon pollution safeguards are bad policy. They would result not only in increased threats to human health and the environment; they would also reduce the prospects for developing and marketing carbon capture and storage systems that could be produced by American firms.

Chairmen and members of the Subcommittees, thank you for inviting me to present NRDC's views on the need for carbon pollution standards for fossil-fueled power plants and on the availability of technology to meet the standards recently proposed by the Environmental Protection Agency (EPA) under the Clean Air Act.

NRDC is a nonprofit organization with more than 400 scientists, lawyers and environmental specialists dedicated to protecting the environment and public health in the United States and internationally, with offices in New York, Washington D.C., Montana, Los Angeles, San Francisco, Chicago, and Beijing. Founded in 1970, NRDC uses law, science and the support of 1.4 million members and online activists to protect the planet's wildlife and natural environment, and to ensure a safe, healthy environment for all living things. NRDC's top institutional priority is curbing global warming and building a reliable, affordable and clean energy future.

We urgently need effective measures to cut dangerous carbon pollution from U.S. power plants and EPA is proceeding appropriately to use the authority Congress directed it to use in the Clean Air Act. Adopting sensible safeguards to cut carbon pollution is long overdue and must not be delayed longer.

Manmade "greenhouse gas" GHG pollution, including CO2, is disrupting the climate that has supported the rise of modern civilization over the past 20,000 years. If we do not act now to cut these harmful pollutants, we will lock in dangerous changes to our climate system that will result in death, disease and misery for billions of people over hundreds of years into the future.

Because our climate has been so stable for so many centuries, we tend to forget how much our well-being depends on that stability. All of our lives are built around the climate that has prevailed for millennia as our communities have been settled and expanded. Our daily existence depends on the smooth functioning of numerous energy, transport, water supply, and waste water systems that have cost trillions to put in place. Nearly all of these complex engineered systems have been designed and

constructed based on assumptions that the climate of the past is a reliable predictor of the climate of the future. Thus, we have standards to design against the "100-year flood" for example. But we can no longer assume that the 100-year flood event of the past will be the 100-year flood of the future. Climate change rules out that assumption as a basis for prudent decision-making.

The potential threats of a disrupted climate for infrastructure are huge. Just last week, two major reports on the extent of these threats were released: one by the U.S. Government Accountability Office (GAO)[1] and one led by the Oak Ridge National Laboratory.[2] The GAO report documents that numerous components of our energy system (including drilling platforms, refineries, pipelines, barges, railways, storage tanks, power plants, power lines, and substations) are vulnerable to a range of climate change impacts. GAO notes that "impacts to infrastructure may also be amplified by a number of broad, systemic factors, including water scarcity, energy system interdependencies, increased electricity demand, and the compounding effects of multiple climate impacts."

The Oak Ridge report contains a number of findings underscoring the threats posed by climate change to infrastructure and urban areas:

> "Regarding implications of climate change for infrastructures in the United States, we find that:
> - Extreme weather events associated with climate change will increase disruptions of infrastructure services in some locations.
> - A series of less extreme weather events associated with climate change, occurring in rapid succession, or severe weather events associated with other disruptive events may have similar effects.
> - Disruptions of services in one infrastructure will almost always result in disruptions in one or more other infrastructures, especially in urban systems, triggering serious cross-sectoral cascading infrastructure system failures in some locations, at least for short periods of time
> - These risks are greater for infrastructures that are:
>   - Located in areas exposed to extreme weather events
>   - Located at or near particularly climate-sensitive environmental features,

[1] U.S. G.A.O., "Climate Change – Energy Infrastructure Risks and Adaptation Efforts," GAO-14-74. http://www.gao.gov/assets/670/660558.pdf

[2] U.S. Department of Energy, "Climate Change and Infrastructure, Urban Systems, and Vulnerabilities," http://www.esd.ornl.gov/eess/Infrastructure.pdf

such as coastlines, rivers, storm tracks, and vegetation in arid areas
- Already stressed by age and/or by demand levels that exceed what they were designed to deliver
- These risks are significantly greater if climate change is substantial rather than moderate

"Regarding implications of climate change for urban systems in the United States, we find that:
- Urban systems are vulnerable to extreme weather events that will become more intense, frequent, and/or longer-lasting with climate change
- Urban systems are vulnerable to climate change impacts on regional infrastructures on which they depend
- Urban systems and services will be affected by disruptions in relatively distant locations due to linkages through national infrastructure networks and the national economy
- Cascading system failures related to infrastructure interdependencies will increase threats to health and local economies in urban areas, especially in locations vulnerable to extreme weather events
- Such effects will be especially problematic for parts of the population that are more vulnerable because of limited coping capacities."[3]

The threats posed by a disrupted climate go far beyond impacts on infrastructure. They include adverse health impacts from disease, vectors, and heat stress. And they threaten food production through drought, floods, and disruption of pollinators.

Our political system may ignore these threats today but the natural systems we are disturbing will not pay attention to our politics. They will proceed to react to our continuing loading of the atmosphere with heat-trapping pollution, uninfluenced by any rationalizations we craft. More climate disruption will be locked in with every year that we fail to take it seriously.

Fortunately, the United States has the economic strength, technical know-how, and policy tools that can show the world we can address this threat in a manner that secures our economic future.

The Clean Air Act is one of those tools. In 2007 and again in 2011 the U.S. Supreme Court ruled that the Clean Air Act authorizes EPA to set sensible safeguards for CO2 and other GHG pollutants. EPA has already set GHG standards for new cars and trucks, with the cooperation of domestic and foreign

[3] DOE report, note 2, at viii-ix.

manufacturers. EPA is now in the process of developing standards for the largest U.S. source of CO2 pollution, fossil-fueled power plants.

Fossil-fueled power plants are also the largest CO2 source globally. We cannot protect ourselves from the harms of a severely disrupted climate system unless we set effective standards to limit carbon pollution from these plants.

As you know, EPA has proposed, and reproposed, CO2 standards for new natural gas and coal power plants. Under the Clean Air Act, EPA bases new source emission standards on the demonstrated capability of known technology, although source operators are free to use any approach they choose to meet the emission limits. Under the Act, EPA's standards must be based on a record that shows that two tests are met. First, the standards must be shown to be achievable using technologies that EPA has found to be demonstrated as technically feasible. Second, EPA must show that the costs of applying those technologies are reasonable. There are numerous cases interpreting these provisions in the context of previous New Source Performance Standards dating back to the early 1970s. As I will discuss, EPA's proposed CO2 standards for new fossil plants are based on showings that are fully in accord with the Act and the prior court rulings interpreting it.

In its recent reproposal, EPA based the proposed standard for new coal plants on currently available systems that capture CO2 from large industrial gas streams. Once captured, CO2 is compressed and transported, typically via pipeline, to geologic formations, where it can be permanently isolated from the atmosphere, eventually being converted back into a mineral form.

As I will discuss in more detail below, all aspects of these carbon capture and storage (CCS) systems have been demonstrated at commercial scale industrial facilities for decades. They have operated reliably over multi-year periods to capture, transport, and safely dispose of millions of tons of CO2. They can be

readily applied at power plants, although until now, CCS has been used only to capture a fraction of CO2 emissions at about a dozen power plants, typically for sale to the food and beverage industry.

To date, the power sector has not used CCS broadly; but not because of any technical shortcomings. Rather, the sector has not applied CCS to full exhaust streams because of a policy failure. Up to now, there has been no national requirement to limit carbon pollution from power plants. CCS systems, like SO2 scrubbers, mercury controls, fine particulate controls, and nitrogen oxide controls, are not free. With rare exceptions, none of these other systems were used before there were regulatory requirements to control these pollutants. Congress wisely decided to give EPA the authority to impose clean air requirements to protect our health and welfare and this has resulted in trillions of dollars in benefits—exceeding compliance costs by a factor of 40 to 1.[4] Likewise, in the absence of any requirement to limit CO2 pollution from new or existing power plants, there has been simply no reason for owners and builders of power plants to install CCS systems.

Large coal-based power companies themselves have argued that they cannot finance CCS systems without federal CO2 standards. For example, in announcing the abandonment of a large-scale CCS project in 2011, the CEO of American Electric Power stated, "as a regulated utility, it is impossible to gain regulatory approval to recover our share of the costs for validating and deploying the technology without federal requirements to reduce greenhouse gas emissions already in place. The uncertainty also makes it difficult to attract partners to help fund the industry's share."[5]

As with other control technologies, there are some rare pioneers for CCS. Currently several plants that will include CCS are either under construction or in the advanced pre-construction stage. Southern Company's new Kemper County, Mississippi coal plant and the refurbished coal plant at the Boundary Dam site in Canada are examples of CCS-equipped coal power projects nearing the end of construction.

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[4] See EPA Benefits and Costs of Clean Air Act reports at http://www.epa.gov/air/sect812/index.html

[5] http://www.aep.com/newsroom/newsreleases/Default.aspx?id=1704

The Summit Power project in Texas and the Hydrogen Energy project in California are examples of CCS-equipped projects in the advanced pre-construction stages.

Yet some industry critics of EPA's power plant carbon pollution proposal have argued that EPA cannot base a standard on CCS because it has not been used commercially at full scale on existing power plants. Congress wisely did not create such a Catch-22 obstacle under the Clean Air Act. Since, in many instances pollution control technology is not used in a particular industry until it is required, Congress did not write the Clean Air Act to bar EPA from basing standards on technology that was not yet in use in a particular industry. The Clean Air Act, adopted with strong bipartisan support, sets forth a sound policy for cleaning up pollution from large new industrial sources. EPA is directed to set New Source Performance Standards, which are to be set at a level that EPA can show are achievable as a technical matter and at reasonable cost. The Act does not compel EPA to put on blinders and look only at the prevailing practice in the industry it is attempting to clean up.

The courts have upheld EPA's authority under the Clean Air Act to base New Source Performance Standards for a given industrial category on technologies whose performance has been demonstrated at other industrial categories.[6] This is a common sense policy. If the law allowed a particular industry to immunize itself from requirements to use available, feasible control technologies just by refusing to adopt them voluntarily, the industry would be put in full control of whether it would ever have to improve its performance.

EPA's Proposed CO2 NSPS for Power Plants

Turning to EPA's proposal for new power plants, the agency considered several options for new coal plant CO2 limits, ranging from no CCS, partial CCS, and full (90%+ capture) CCS. EPA selected partial CCS as the basis for the proposed standard, after considering both technical and cost issues. EPA found that

[6] See, e.g., *Lignite Energy Council v. EPA*, 198 F.3d 930 (D.C. Cir. 1999).

partial CCS was well demonstrated at relevant industrial scales and that when applied to coal power plants, partial CCS would have reasonable economic impacts.

As to technical feasibility, the record shows ample evidence to support the finding that CCS is a technically viable system for new coal-fired power plants. EPA has recently published a Technical Support Document that provides an expanded summary of the real-world experience with all three elements of a full CCS system: separation/capture of CO2 from industrial gas streams; compression and pipeline transport of CO2; and injection of CO2 into secure geologic formations.[7]

CO2 Capture

EPA 's January 2014 Technical Support Document (TSD) notes that industrial CO2 capture experience dates back to the 1930s. It explains that there are three types of capture systems applicable to power plants: post-combustion capture; pre-combustion capture; and oxy-combustion. In the power sector itself, there exist three types of real-world experience: commercial small-scale capture systems at existing coal-fired power plants; demonstration projects at power plants; and larger-scale projects now under construction or in advanced planning and development. EPA's TSD mentions two U.S. coal-power plants that use commercial amine scrubbers to capture CO2 for sale to the food and beverage industry.[8] These markets are so small that only a small portion of each plant's flue gas is passed through the scrubbing system. But the technology is proven and is scalable to sizes needed for a new plant to meet EPA's proposed standard. As EPA points out, engineering studies, the Boundary Dam coal plant in Canada, (where the CO2 capture system for a refurbished 110MW unit has been completed on budget—

[7] US EPA, Technical Support Document, Jan 8, 2014, http://1.usa.gov/1l2qV7x
[8] EPA TSD at 18.

other parts of the unit refurbishment experienced some cost overruns), as well as a plant being developed by NRG Energy in Texas, demonstrate the scalability of such post-combustion systems.[9]

As an example of pre-combustion capture operating experience, there is the Dakota Gasification Company's Great Plains Synfuels plant in North Dakota. This plant, which gasifies coal and produces pipeline gas (methane) and other chemicals, captures its CO2 and pipelines it for injection into an oil field in Canada. As we know, methane is an increasingly popular fuel for combined-cycle power plants. Were the pipes at the Great Plains plant connected to a combined-cycle power plant we would have a large-scale operating example of a power plant using fuel derived from coal, where CO2 capture was applied. There are no technical issues presented by the fact that the gas in those pipes currently is distributed in the general gas supply network rather than running to a gas-fired generating unit directly.

These examples alone are sufficient under the Clean Air Act to demonstrate that CO2 capture is technically feasible for new coal power plants.

Experts in the power industry confirm the technical viability of CO2 capture at large power plants. For example, Mississippi Power Company stated the following to the Mississippi Public Service Commission in 2009 in its application for approval of its large new coal plant in Kemper County, Mississippi:

> "a process referred to as Selexol™ is applied to remove the CO2 such that it is suitable for compression and delivery to the sequestration and EOR process. … The carbon capture equipment and processes proposed in this Project have been in commercial use in the chemical industry for decades and pose little technology risk."[10]

In elaborating on the viability of CO2 capture for this plant, the Vice President of Mississippi Power Company testified to the Commission as follows:

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[9] TSD at 18-19.

[10] Kemper County IGCC Certificate Filing at 18, MPSC Docket No. 2009-UA-0014. Filed, December 7, 2009. http://bit.ly/1dt3eUr

> "The carbon capture process being utilized for the Kemper County ICGC is a commercial technology referred to as Selexol™. The Selexol™ process is a commercial technology that uses proprietary solvents, but is based on a technology and principles that have been in commercial use in the chemical industry for over forty years. Thus, the risk associated with the design and operation of the carbon capture equipment incorporated into the Plant's design is manageable."[11]

Compression and Transport of CO2

There is no need to spend much time on this topic. It is beyond dispute that the technology to compress CO2 and transport it by pipeline in quantities pertinent to power plant operations is fully demonstrated, with decades of operational experience. As EPA's Technical Support Document notes, currently about 50 million metric tons of CO2 are transported annually in the U.S., through 3,600 miles of pipeline.[12] The sources of the CO2 do not include electric generating plants but that is immaterial to the question of the performance of this component of the CCS system.

Geologic Storage of CO2

The issue of whether large quantities of compressed CO2 can be safely placed for long-term storage in geologic formations is an important one and one which was a matter of substantial concern for me personally when I first examined the issue of CCS starting in 1997. I have devoted a considerable amount of time since then studying the literature and discussing the topic with a broad range of geologists. I also participated in a reviewer capacity in the IPCC's 2005 Special Report on Carbon Capture and Storage.[13]

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[11] Phase Two Direct Testimony of Thomas O. Anderson at 22. Filed, December 7, 2009. http://bit.ly/1g1lHs0 . Additional examples of commercial offerings can be found in the Appendix attached to this testimony.

[12] EPA TSD at 25.

[13] IPCC, 2005 - Bert Metz, Ogunlade Davidson, Heleen de Coninck, Manuela Loos and Leo Meyer (Eds.), Carbon Dioxide Capture and Storage,
Cambridge University Press, UK.

In my judgment, the IPCC and EPA are correct in concluding that large-scale geologic storage is technically viable as a means of isolating CO2 from the atmosphere until it is eventually converted into mineral form. The basics are easily understood: first one needs a formation of porous rock into which the compressed CO2 can be injected, at a depth sufficient to keep the CO2 in a compressed state; then because CO2 is less dense than the fluids in the injection zone, there needs to be an impermeable rock formation above the injection zone; finally, the impermeable rock formation needs to be free from faults, fractures, or well bores that could provide pathways to the surface or overlying water supplies. A number of surveys have documented that formations meeting these criteria are abundant in the United States. For example, a study by researchers at DOE's Pacific Northwest National Laboratory found that 95% of the largest CO2 emitters in the U.S. (nearly all of them coal power plants) are located within 50 miles of a candidate CO2 storage formation.[14]

There is substantial commercial industrial-scale experience with CO2 injection into geologic formations, both in the U.S. and internationally. Most of the injected CO2 has gone into U.S. oil fields for enhanced oil recovery (EOR) but there are also a number of large CO2 injection projects in operation at dedicated CO2 storage sites: under the North Sea, the Barents Sea, Algeria, and Australia.[15]

Costs

Under the Clean Air Act and court decisions interpreting it, NSPS standards are authorized if the costs of compliance are shown to not be "excessive" or "unreasonable."[16]

[14] Dooley, J., et al. Carbon Dioxide Capture and Geologic Storage: A Key Component of a Global Energy Technology Strategy to Address Climate Change; Joint Global Change Research Institute, Pacific Northwest National Laboratory: College Park, MD, May 2006, 2006; p 67. See also the U.S. Geological Survey Carbon Atlas: http://co2public.er.usgs.gov/viewer/

[15] This experience is detailed in EPA's TSD at 26-29.

[16] See citations in EPA's 2014 proposed rule at 79 FR 1464, Jan. 8, 2014.

EPA's cost analysis demonstrates that the costs of complying with the proposed CO2 standards easily meet these tests: while more costly than natural gas power options, the standards can be met at costs that fall in the range of other generating plant options that the industry is building or planning to build. EPA's cost assessment starts with the observation that under current and expected market conditions, new natural gas combined cycle (NGCC) power plants would typically have lower electricity production costs (levelized cost of electricity) than new coal units, even if no CCS were required for the coal unit. But EPA notes that there might be instances where factors other than electricity production costs might cause investors or regulators to choose to build a coal plant or other non-NGCC power plant. Accordingly, EPA compared the projected cost (using Department of Energy reports) of a coal unit with CCS to a coal unit without CCS and to other non-NGCC options, such as nuclear, biomass, and geothermal power plants.

In its analysis, EPA concludes the projected costs of a coal plant with partial CCS would range from $92 to $110 per Megawatt-hour (MWh). This projected cost falls in the range for other non-NGCC options of $80 to $130 per MWh. EPA also compares the cost of a new coal unit with *no CCS* to a coal unit with partial CCS, finding that applying partial CCS would increase the power production costs[17] compared to the no-CCS case by 20% -- from $92 per MWh to $110 per MWh, if the CCS project received no revenues from the sale of CO2 for enhanced oil recovery (EOR). If the income from CO2 sales for EOR were included, the net production cost from the new CCS-equipped unit would range from $88 to $96 per MWh, depending on the price received for the captured CO2.[18]

[17] Power production costs are only a portion of a customer's bill. Typically, about 40% of the bill consists of transmission, distribution and administrative costs. Moreover, in most systems, any single new power plant is only a small part of the total generating fleet whose costs go into the customer rate base. Thus, the increase in a customer's rates will be smaller than the increase in production costs at a new power plant.

[18] US EPA, "Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units," at 240.
http://www2.epa.gov/sites/production/files/201309/documents/20130920proposal.pdf

In sum, EPA's proposal for new coal plants is based on a careful review of industrial experience with large-scale CO2 capture technology. EPA has compared projected costs of a new coal unit applying partial CCS with several other generation options and concluded the additional power production costs are 20% or less. EPA found these costs to be reasonable, given the substantial reduction in emissions that partial CCS would achieve at a new coal unit and the importance of providing a policy framework to support the use of CCS if new coal units are built.

Efforts to Block EPA Carbon Pollution Standards

Unfortunately, there are continuing misguided efforts to block EPA from adopting sensible safeguards for dangerous carbon pollution from fossil power plants, most recently with House passage of Rep. Whitfield's bill (H.R. 3826) last week. From the perspective of coal advocates, the rationale for these attacks on the Clean Air Act appears to be that Congress can protect the volumes of coal consumed by the power sector by prohibiting EPA from setting any meaningful limits on carbon pollution from power plants. This tactic simply will not work.

A careful examination of the forces confronting the coal industry shows that handcuffing EPA cannot be a successful way to improve the lot of coal producers. Most U.S. coal use is in the power sector and the power sector has choices for the resources it uses. The bill passed by the House seems to ignore the obvious fact that power producers are not in business in order to burn coal. Their business interest is in cost-effectively supplying electricity resources; and their fuel and technology choices will be driven by market forces that together are much more powerful than the effects of Clean Air Act standards on power production prices.

The biggest drivers of the market's continuing shift away from coal in the power sector are –

- the comparatively lower costs of natural gas as a fuel,
- the comparatively lower capital costs of natural gas power plants,
- the expanded penetration of renewables like wind and solar,
- the success of demand side management in reducing both annual and peak demands for power,

- and the conviction in much of the investor community, that climate science and observed climate disruptions will lead to public demands for policies to limit carbon emissions, likely before investments in new or refurbished coal plants are recouped.

Ironically, the Whitfield bill would stop the improvement of the one technology that is essential if coal and natural gas are to continue to be a substantial energy resource: CCS. The bill cannot and will not do anything to deal with the fundamental issues facing the continued use of coal. If it became law (which it almost certainly will not), it would be at most only an anesthetic that might provide coal producers with some perceived short-term pain relief but at the cost of causing investors and government actors to turn their back on deploying CCS. This would leave the coal industry where it is today: unable and unwilling by itself to build CCS projects that provide cost-cutting practical experience at pertinent scales; and largely failing in its efforts to maintain sales to power sector customers who are increasingly not wedded to coal and thus quite apathetic about building CCS projects themselves.

Perhaps inadvertently, the bill essentially ensures that coal producers will have no chance of turning CCS into a real option for power sector investors. By telling coal producers' customers (power plant owners) that they can indefinitely avoid any meaningful EPA limits on carbon pollution by simply declining to pursue CCS projects, the bill eliminates any incentive for power producers to put their political and financial muscle into an effort to solve coal's carbon problem.

Indeed, if this bill were law, it would tell power plant owners that pursuing a CCS project would be against their narrow economic interests because it would speed the day when the handcuffs on EPA's authority would be removed.

Coal producers are profoundly wrong in betting that blocking the use of the Clean Air Act to deploy CCS would revive interest in coal as a new power plant option. The reality is that hamstringing EPA will not keep coal from continuing to lose market share in the U.S. Instead, it will cause the power sector to look

elsewhere to hedge its bets against the implications of climate disruption. Some in the coal-producing sector may think one can deal with climate disruption by enacting laws decreeing that we shall ignore it. But based on my conversations with many leaders in the power sector, that is not a view shared by the people who will be deciding what investments to make in new and existing power systems.

Some claim that today there is a "war on coal," while others, considering the health and environmental costs inflicted by today's use of coal to make electricity, say it is a "war by coal." But these charges and countercharges will not get us where we need to go as a society. What all of us need, both coal promoters and coal critics, is a broader consensus on sensible steps we can take to put our energy system on a more sustainable course. I continue to believe that it is possible to forge a consensus that includes a role for coal, at least as our society transitions in an orderly manner to resources that will function reliably to power growth without disrupting the climate we depend on to sustain modern economies.

A bill passed by the House in 2009 demonstrates that it is possible to garner the support of many legislators far from "coal country" for policies that would give coal an opportunity to define a role for itself as a continuing part of the U.S. energy mix. That bill, authored by two Democrats from states not dependent on coal, included about $60 billion in financial support for deployment of CCS on coal-fueled power plants. It is worth noting as well, that many environmental organizations that believe coal use must be phased out quickly, nonetheless supported this legislation.

I am referring to the Waxman-Markey climate protection bill. It did not become law but it does stand as a reminder that it is possible to broaden political support among elected officials from around the country for policies that could in fact provide a pathway for coal to earn a continuing role as a significant U.S. energy resource.

The bill passed by the House last week would create a huge obstacle to reviving any potential consensus for incentives to deploy CCS. It is based on a fundamentally flawed strategy: that by barring EPA from considering practical, available technologies that can reduce power plant carbon pollution, Congress can spur new coal plant investments and keep old coal plants running indefinitely. Succeeding with this strategy would require investors, power company managers, and state utility regulators to deny both economic and climate risks.

A new coal plant without CCS is simply not equipped to manage the risks that it will face in the marketplace. Some coal producers may be able to persuade themselves that it makes sense to spend several billion dollars on a machine that will be the dirtiest new power option in the United States. But coal producers won't be building power plants. And the people who will be are not going to believe that this bill provides them a stable platform for investing billions in projects that won't even be on line for perhaps another decade. Power sector investors are increasingly learning from Wayne Gretzky: they are skating to where the puck will be, not where it is now. The Whitfield bill tries to tell them there is no puck and that just won't fly.

In sum, EPA's proposed carbon pollution standards are technically achievable and can be met at reasonable costs. The standards are essential to assure that coal-based power plants will be designed to be operable in a world where climate disruption demands that we minimize carbon pollution. Efforts to block EPA's Clean Air Act authority to cut carbon pollution are not just bad for public health and the environment. They are bad for America's economic future and for the prospects of making continued use of fossil fuels for power generation compatible with protecting the climate that human society depends on to thrive in the future.

APPENDIX:

COMMERCIAL OFFERINGS

PRE-COMBUSTION CAPTURE TECHNOLOGY

Selexol

The Selexol technology is a proven technology, licensed by UOP.

UOP Selexol™ Technology for Acid Gas Removal, © 2009 UOP LLC. All rights reserved.[19]

"Selexol Process Commercial Experience

- *Over 60+ operating units*
  - *[…]*
- *Multiple large units in engineering phase*
  - *[…]*

Selexol Process-Summary

- *The Selexol process is a proven licensed technology"*

"Phase Two Rebuttal Testimony Of Thomas O. Anderson On Behalf Of Mississippi Power Company Before The Mississippi Public Service Commission", Docket No. 2009-UA-0014[20]**:**

"[…] the market for carbon capture systems in synthesis gas stream applications is very mature. The Company is aware of at least 20 different CO2 control technologies that have been installed in over 250 industrial applications worldwide. Mr. Schlissel appears to have confused traditional coal plant technology where carbon capture would be "post-combustion," meaning the CO2 is removed from the flue-gas after it has been used in the production of electrical energy, with the Project's IGCC technology where the CO2 removal process will occur "pre-combustion," meaning the CO2 is removed from the gasifier's synthesis gas prior to being used to produce electrical energy. The CO2 capture market for pre-combustion synthesis gas applications is mature, robust and global."

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[19] http://www.uop.com/?document=uop-selexol-technology-for-acid-gas-removal&download=1

[20] http://www.psc.state.ms.us/InsiteConnect/InSiteView.aspx?model=INSITE_CONNECT&queue=CTS_ARCHIVEQ&docid=246453

"Updated Design, Description and Cost of Kemper County IGCC Project", Mississippi Power Company, MPSC Docket No. 2009-UA-0014, Kemper County IGCC Certificate Filing, Filed Dec. 7, 2009[21]:

"In addition, a process referred to as Selexol™ is applied to remove the CO2 such that it is suitable for compression and delivery to the sequestration and EOR process. All of the CO2 capture systems are installed prior to combustion of the syngas in the gas turbines. Capturing CO2 pre-combustion is much more efficient and less costly than post-combustion. The carbon capture equipment and processes proposed in this Project have been in commercial use in the chemical industry for decades and pose little technology risk."

"The carbon capture process being utilized for the Kemper County ICGC is a commercial technology referred to as Selexol™. The Selexol™ process is a commercial technology that uses proprietary solvents, but is based on a technology and principles that have been in commercial use in the chemical industry for over forty years. Thus, the risk associated with the design and operation of the carbon capture equipment incorporated into the Plant's design is manageable."

Rectisol

The process dates from 1955, and is commercially proven and guaranteed.

"Acid Gas Removal by the Rectisol® Wash Process", Chemical Industry Digest, June 2013[22]:

"Rectisol was developed jointly by Linde and Lurgi in the late 50's and both companies are owning the IP rights. Easy to operate, very reliable, extremely high on-stream factor"

Linde Engineering website[23]:

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21 http://www.psc.state.ms.us/InsiteConnect/InSiteView.aspx?model=INSITE_CONNECT&queue=CTS_ARCHIVEQ&docid=245160

22 http://www.linde-india.com/userfiles/image/2013_07_18_%20Rectisol%20Article%20in%20Chemical%20Industry%20Digest.pdf

23 http://www.linde-engineering.com/en/process_plants/hydrogen_and_synthesis_gas_plants/gas_processing_plants/rectisol_wash/index.html

"Rectisol can purify synthesis gas down to 0,1 vppm total sulfur (including COS) and CO2 in ppm range. Commercial scale RECTISOL wash units are operated worldwide for the purification of hydrogen, ammonia-, methanol syngas and the production of pure carbon monoxide and oxogases."

Hydrogen Energy International (a joint venture of BP and Rio Tinto) sought to develop a commercial CCS project with 90% carbon capture in California. In their feasibility study, they describe their assessment of the Rectisol process.

"HECA Feasibility Study, Report #23 – AGR Licensor Evaluation", February 7, 2010.[24]

"Key to the Licensors' success in meeting the minimum project requirements is their commercially proven experience. Both Licensors have over 50 Rectisol units in operations worldwide with extensive experience removing acid gas from syngas produced in both liquid and solid fuel gasifiers, including Shell and GE (Texaco) gasifiers. Both have designed nits with clean syngas specifications more stringent than HECA's hydrogen rich fuel gas specification for the manufacture of chemicals. Both have designed units to produce acid gas within the H2S concentrations specified by the HECA project from low rations of H2S/CO2 in the feed gas, and CO2 product streams with the HECA purity requirements. Both licensors do have different units in operation demonstrating each aspect of the product specification requirements.

Summit Power's Texas Clean Energy Project, a 40MWe gross IGCC project in Texas with 90% carbon capture will also use Rectisol.[25]

POST-COMBUSTION CAPTURE TECHNOLOGY

Shell-Cansolv

The small Canadian company, Cansolv developed a proprietary amine technology, and was bought up by Shell in Dec, 2008. Since then, Shell-Cansolv has expanded its capabilities and commercial offerings.[26] On CO2 capture in particular, **the company's website states that[27]:**

"[t]his patented technology is designed and guaranteed for bulk CO2 removal up to 90%"

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[24] http://www.cpuc.ca.gov/NR/rdonlyres/538A0BA6-F6C9-495D-B13B-1399E446CDEC/0/23AGRLicensorEvaluation7Feb2010.pdf

[25] http://www.netl.doe.gov/publications/proceedings/10/co2capture/presentations/thursday/Barry%20Cunningham-FE0002650.pdf

[26] http://www.shell.com/global/products-services/solutions-for-businesses/globalsolutions/shell-cansolv/shell-cansolv-solutions.html

[27] http://www.shell.com/global/products-services/solutions-for-businesses/globalsolutions/shell-cansolv/shell-cansolv-solutions/co2-capture.html

In September, 2013, Shell-Cansolv and French engineering, procurement and construction firm, Technip, announced[28]:

"an agreement to leverage their respective expertise in marketing an end-to-end solution for Carbon Capture and Sequestration (CCS) projects. The agreement enables both Technip and Shell Cansolv to offer a full chain of engineering, procurement and construction (EPC) services for a post-combustion CO2 capture project to the power generation industry. The collaboration between two industry leaders will see Shell Cansolv capitalize from Technip's experience in the design, construction, and management of large EPC projects and its commercial global footprint. This new cooperation will also expand Shell Cansolv's international reach by giving the company a platform to offer its CO2 capture technology in increased scope as well as to new markets."

According to DLA Piper[29], "Engineering, Procurement and Construction (EPC) contracts are the most common form of contract used to undertake construction works by the private sector on large-scale and complex infrastructure projects. Under an EPC contract, a contractor is obliged to deliver a complete facility to a developer who need only turn a key to start operating the facility, hence EPC contracts are sometimes called turnkey construction contracts. In addition to delivering a complete facility, the contractor must deliver that facility for a guaranteed price by a guaranteed date and it must perform to the specified level. Failure to comply with any requirements will usually result in the contractor incurring monetary liabilities."

Saskpower's Boundary Dam CCS project, which is currently under constructions, is using the Shell-Cansolv process. SNC Lavalin is the EPC contractor there, and has to deliver the following process guarantees described in **"Inside Boundary Dam, The Carbon Capture Technology At The Heart Of The World's Largest Post Combustion CCS Project"; Devin Shaw, Manager – Strategic CCS Projects, January 23rd, 2014[30]:**

- *"Steam Consumption*
- *CO2 Removed (delivered for compression)*
- *Electricity consumption on critical equipment*
- *Solvent(s) & chemical consumption"*

[28] http://www.technip.com/en/press/technip-and-shell-cansolv-strengthen-co2-capture-technology

[29] http://www.dlapiper.com/files/Publication/18413b26-49b8-490e-acc6-3ff54faa55d7/Presentation/PublicationAttachment/1205e08d-e585-479d-ac17-42135efaf044/epc-contracts-in-the-power-sector.pdf

[30] http://wyia.org/wp-content/uploads/2014/01/devin-shaw.pdf

Mitsubishi Heavy Industries KM CDR Process/KS-1 Amine Solvent

Mitsubishi Heavy Industries (MHI) developed the Kansai Mitsubishi Carbon Dioxide Recovery Process (KM CDR Process) for CO2 capture, which uses a proprietary hindered amine solvent, called KS-1. Commercial applications to date have been on fertilizer and chemical plants, with maximum capture capacity up to 450 tons per day (T/D). MHI has also developed a large-scale basic design package for a 3,000 metric T/D -single train capture unit.

According to MHI's website:

"[t]he package is now ready for delivery on demand under full commercial arrangements" for gas boilers.[31]

The KM CDR Process is used at Southern Company's Plant Barry coal-fired power plant in Mobile, Alabama. For the first stage of the project, 0.15 million tons of CO2 is being captured annually from a 25 MW slip stream. The captured CO2 is being sequestered in a saline reservoir at Denbury Resources' Citronelle Oil Field in Bucks, Alabama in partnership with the Southeast Regional Carbon Sequestration Partnership (SECARB).

"World's First Integrated CCS of Coal-fired Power Plant Emissions Begins"; Mitsubishi Heavy Industries America, Inc., Tuesday, September 18, 2012.[32]

"Through participation in the world's largest-scale CO2 capture project at Plant Barry, MHIA intends to show the high-level economic feasibility and reliability of MHIA's technology in the commercial-scale CO2 capture from coal-fired power plant flue gas, and looks to further its commercialization globally".

Econamine

"Fluor's Econamine FG Plus^{SM} Technology For CO2 Capture at Coal-Fired Power Plants"; Satish Reddy, Dennis Johnson, John Gilmartin; Presented at the Power Plant Air Pollutant Control "Mega" Symposium, August 25-28, 2008, Baltimore, Maryland.[33]

"Fluor's proprietary Econamine FG^{SM} technology is a proven, cost-effective process for the removal of CO2 from low-pressure, oxygen containing flue gas streams. The performance of the process has been successfully demonstrates on a commercial scale over the past 20 years.

Through rigorous laboratory and field tests, Fluor has made added several enhancement features to further reduce the process energy consumption. In conjunction with the Econamine FG^{SM} technology, these enhancement features are now available at the improved Econamine FG Plus^{SM} technology. Any

[31] https://www.mhi.co.jp/en/products/detail/km-cdr_largeplant.html
[32] http://www.mitsubishitoday.com/ht/display/ArticleDetails/i/9454
[33] http://www.fluor.com/SiteCollectionDocuments/EFG_forCO2CaptureatCoal-FiredPowerPlants-PPAP_Aug2008.pdf

combination of these enhancement features can be assembled in a custom-fit solution to optimize each and every CO2 capture application. Furthermore, the Econamine FG Plus[SM] process offers an improved environmental signature and can be configured around tight area requirements.

Fluor has developed a pre-treatment process for applying EFG+ technology to coal fired power plants. The strategy consists of three options for polishing scrubbing and incorporates Fluor's experience in large FGD projects"

"Report to the Global CCS Institute, Final Front-End Engineering and Design Study Report"; Tenaska Trailblazer Partners, LLC, January, 2012.[34]

"Tenaska and Fluor achieved the goals of the CC Plant FEED study, resulting in:

- *A design which meets Tenaska and industry standards and notably so in the areas of safety (through incorporation of the findings from the hazard and operability study and air dispersion modeling) and environmental profile (through specification of the CO2 capture rate at and permitted air emissions in the design basis);*
- *Confirmation that the technology can be scaled up to a constructable design at commercial size through (1) process and discipline engineering design and computational fluid dynamics (CFD) analysis, (2) 3D model development, and (3) receipt of firm price quotes for large equipment;*
- *[…]*
- *Establishment of performance guarantees which, after the addition of an appropriate margin, were consistent with the expected performance in Fluor's indicative bid."*

[34] http://cdn.globalccsinstitute.com/sites/default/files/publications/32321/traiblazer-front-end-engineering-and-design-study-report-final.pdf

DAVID G. HAWKINS

Director, Climate Programs
Natural Resources Defense Council

David G. Hawkins began his work in "public interest" law upon graduation from Columbia University Law School in 1970. He joined the Natural Resources Defense Council's (NRDC) Washington, DC office in 1971 as one of the organization's first staff members.

In 1977, Mr. Hawkins was appointed by President Carter to be Assistant Administrator for Air, Noise, and Radiation at the Environmental Protection Agency. During his time at EPA, he was responsible for initiating major new programs under the 1977 Amendments to the Clean Air Act. With President Reagan's election in 1981, Mr. Hawkins returned to NRDC to co-direct NRDC's Clean Air Program.

In 1990, Mr. Hawkins became Director of NRDC's Air and Energy Program, and in 2000 he became the Director of NRDC's Climate Center. NRDC's climate work focuses on advancing policies and programs to reduce the pollution responsible for global warming. Mr. Hawkins has worked with Congress, the Executive Branch, and various members of the business community to design policies that will slow, stop and reduce the emissions of global warming pollution. Mr. Hawkins is recognized as an expert on advanced coal technologies and carbon dioxide capture and storage. He assumed his current position as Director, NRDC Climate Programs in 2011.

Mr. Hawkins currently serves on the boards of the Woods Hole Research Center, Resources for the Future and the Center for Clean Air Policy. He has previously served on the Board on Environmental and Energy Systems of the National Academy of Sciences and the U.S. Department of Energy's Climate Change Science Program Product Development Advisory Committee. Mr. Hawkins participated in the Intergovernmental Panel on Climate Change's Special Report on Carbon Dioxide Capture and Storage and in the IPCC's Fourth Assessment Report on climate change.

Mr. Hawkins is married with three children and lives in Connecticut.

Testimony of Robert Hilton
Before the U.S. House of Representatives
Subcommittee on Environment and Subcommittee on Energy
Of the Committee on
Science, Space, and Technology
Hearing on **Science of Capture and Storage: Understanding EPA's Carbon Rules**

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March 12, 2014

Introduction

Good morning. My name is Robert Hilton. I hold the position of Vice President, Power Technologies for Government Affairs for Alstom. I would like to thank Chairman Schweikert and Chairwoman Lummis and Ranking Members Bonamici and Swalwell as well as the entire Subcommittees for this opportunity to address these key issues on Carbon Capture.

Alstom is a global leader in the world of power generation, transmission, and transportation infrastructure. We set the benchmark for innovative and environmentally friendly technologies. More than 50% of the power plants in the United States have Alstom equipment, 40% of the electricity in the US is dispatched over Alstom software, and 25% of the world's electricity is generated on Alstom equipment. Alstom has the world's largest service business devoted to the maintenance of power generation equipment and is the world's largest air quality control company.

Alstom employs more than 93,000 people in 100 countries, and had sales of $27 billion in 2012-2013. In the U.S., Alstom employs approximately 7,000 full time permanent employees in 45 states. That number virtually doubles when you include workers hired for specific projects.

Alstom has a broad portfolio of power generation technology options: including coal, oil, natural gas, wind (both on shore and off shore), and hydro, biomass, geothermal, solar and nuclear. Significant pillars of our program are rapid and successful deployment of non-$C0_2$ sources of generation, namely nuclear and renewables; reduced $C0_2$ emissions through more efficient generation; and the capture of $C0_2$ from fossil fuel powered generation (Carbon Capture and Storage (CCS)). Alstom invests approximately $1 billion annually in research and development with significant activities in the US.

Alstom is a leader in the field of Carbon Capture having completed work on four pilot or validation scale plants and with 10 pilots, validation, and commercial scale demonstration plants in operation, design, or construction worldwide.
These projects include both coal and gas generation facilities. Alstom is commercializing three first generation capture related technologies: chilled ammonia post combustion capture, advanced amine post combustion capture, and oxy-firing combustion technology. We also have second generation technologies in development like chemical looping (in cooperation with Department of Energy (DOE)) and regenerative calcium cycle.

Status of Carbon Capture Technology

My testimony today will address the status of the Carbon Capture portion of CCS as a full scale commercial technology.

Carbon Capture is, within the realm of innovation, no different than any other technology under development. It is required to move through progressive stages of development at consistently larger scale or size. This process has been shown over decades to be the best approach to ensure commercial success by meeting the high

standards of our industry and providing the confidence and reliability required by the power industry and electricity consumers.

Alstom has taken each of its Carbon Capture related technologies from the bench level to small and then larger pilots, followed by validation scale demonstrations with the aim to finally reach commercial scale demonstration. To date, no Carbon Capture technologies have been deployed at commercial scale. Alstom has successfully taken several of its technologies through the validation scale demonstration. This stage is the proof of technology in real field conditions (or in this case actual power plant flue gas). It is at this point we can say confidently that the basic technology works.

However, the final stage to reach commercial status is to perform a demonstration at full commercial scale. There are several reasons for this requirement. It is critical to be at commercial scale to define the risk of offering the technology. This cannot be defined until the technology can be shown to work at full scale. This is the first opportunity that we have to work with the exact equipment in the exact operating conditions that will become the subject of contractual conditions when the technology is declared commercial and is offered under standard commercial terms including performance and other contractual guarantees. This also becomes the first opportunity to optimize the process and equipment to effect best performance and, very importantly, seek cost reduction. These too are required to define commercial contractual conditions. Finally, our customers would be reluctant to invest in Carbon Capture technologies that have not been demonstrated to full commercial scale.

Based on these criteria, Alstom does not currently deem its technologies for Carbon Capture commercial and, to my knowledge, there are no other technology suppliers globally that can meet this criteria or are willing to make a normal commercial

contract for CCS at commercial scale. I emphasize however that the technologies being developed by Alstom and others work successfully.

Clean Air Act Definitions

The Clean Air Act defines four criteria for the application of BSER or Best System of Emission reduction – to coal or anything else. The criteria are supported in the draft Environmental Protection Agency (EPA) New Source Performance Standards (NSPS) for carbon dioxide (CO2) emissions by project examples. My testimony reviews these examples as follows:

Feasibility- is the technology technically feasible?

Looking at the projects cited by EPA at the time of this writing: Kemper is under construction and not demonstrated (reference: Brian Toth presentation at the Coal Technology Symposium' held on March 5, 2014, in Washington D.C.); Sask is under construction and not demonstrated and has delayed start-up until July 2014 (reference: the Honorable Brad Wall, Premier of Saskatchewan at same symposium); TCEP/ Summit is not financed and hasn't started construction (reference: Sasha Meckler of Summit at the same symposium); HECA is not financed and has yet to start construction; NRG Parrish is has yet to start construction; AEP Mountaineer was only 2.3% of the plant gas stream and therefore should not qualify as significant as referenced in the rule making; Basin Electric/ Dakota Gasification is a producer of natural gas and a fertilizer plant - not a power plant. Four of the six projects are gasifiers and high pressure technology not suited to pulverized coal or NGCC (natural gas combined cycle) electricity producing plants (which are at atmospheric pressure). Alstom suggests this summary demonstrates the EPA referenced projects fail to meet the "technically feasible" criteria. These technologies are not operating at significant scale at

any site as of the rule publication. We do not support mandating technology based on proposed projects (many of which may never be built). These facts lead to the conclusion that the technology is not “adequately demonstrated” to be feasible at full scale.

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Cost - are costs reasonable?

Alstom cannot comment in detail about the status of projects proposed by other companies. But based on facts in the public domain I’m aware of no CCS projects that would be considered cost competitive in today’s energy economy. The five carbon capture and sequestration projects cited in the NSPS proposal as examples for having met the cost criteria in the NSPS rule all either rely on EOR or by-product revenue, federal subsidy, or they will not economically dispatch. We would suggest that in setting economic criteria for technology, EPA consider the” typical commercial power plant which will not have federal subsidies and will likely not have access to chemical or EOR revenue. EPA needs to recognize that both chemicals and EOR are niche opportunities and not available to most power plants. In the case of EOR, it works only in proximity to oil fields that can be tapped with tertiary flooding and where pipelines exist to reach those fields; all are unique circumstances not available to the typical commercial power plant in the US.

Size of CO2 emission reductions:

EPA, in the rule, states that this rule will not achieve significant reductions in CO2 emissions.

Technology- will the system promote further development

As detailed below, this regulation will essentially stop the development of CCS. Without new coal plants, it is unlikely technology developers will continue to invest in CCS development. Since the proposed regulation provides a significantly lower cost alternative (NGCC without controls) to the

application of CCS to coal, there is unlikely to be a market for at least 10 years, and most R&D cannot be sustained for that period. Industry bases R&D on market potential and return on investment. With no market in sight, investment will stop. One only need to look at slowing pace of private and public investment world-wide in CCS projects as shown in the annual survey of the Global Carbon Capture and Storage Institute (GCCSI), which results from economic conditions and lack of progress on climate change negotiations as proof that EPA's assumption are unrealistic.

We differ with EPA on the notion that these NSPS regulations will spur development of new technology (as required by Congress in the Clean Air Act).

Let us examine the history of the Clean Air Act (CAA). When the CAA was enacted, the first pollutant was particulate matter. Industry had been developing collectors and precipitators since the 1920's, so was well prepared. When EPA called for sulfur dioxide (Sox) control, the industry had built its first full-scale scrubbers in 1942 and was well prepared. I personally worked on my first full scale scrubber in 1970. When the nitrogen oxides (NOX) State Implementation Plan (SIP) call came in 1999, the industry had been deploying reduction technologies since the early 1980s. When mercury regulation came in 2010, the industry had been deploying mercury systems since the mid-1980s. And in the case of Mercury and Air Toxic Standards (MATS) the industry demonstrated that the originally proposed standards could not be met and worked with EPA to develop EPA's revised MATS standards.

NSPS is different. The issue we are now faced with is the industry did not in earnest begin work on capture of CO2 from atmospheric gases until 2000-2002. The technology is not fully developed and the regulation proposed is ahead of technology development. It should also be noted that carbon capture is much larger, complex

and technically sophisticated compared with any of these previous technologies. From this history, we see that the CAA has been a **market driver** and **not a technology driver**. Industry has always moved to be prepared for the next environmental issue.

Clean Coal Power Initiative (CCPI) Projects

In the Energy Policy Act of 2005, Congress expressly prohibited EPA from basing any regulation on projects receiving CCPI money. EPA has defended its use of these projects to name partial capture on the word "solely." All of the current or proposed plants I'm aware of have received CCPI money except Basin Electric (not a power plant) and Sask (a Canadian project with equivalent Canadian funding). Similarly, none of the projects referenced in the regulation are designed for partial capture except Kemper.

Impacts on Electricity Consumers

The proposed regulations would force generators to move from coal to natural gas, which potentially could have major impact on electricity consumers.

Coal with CCS under current market conditions would not compete with natural gas without CCS due the extreme capital cost of the CCS equipment and additional operating cost as currently viewed by both generators and developers and even in DOE National Energy Technology Laboratory (NETL) studies. Thus, anyone building new generation would logically build Natural Gas Combined Cycle (NGCC) plants. However, let us look at the impact this regulation will have.

With no new coal power generation being built it's our view that this presents a real threat to the US economy both in terms of employment in the industries that build and supply materials for coal plants, as well as coal mining, transportation and

maintaining the necessary skill sets to design, build and operate such plants through a period of 10 or more years of inactivity.

Coal has always been the fuel that balanced electric prices through price spikes of gas and other market conditions. It should be noted that while natural gas is currently low in price and abundant (and projected by EIA to remain so), dependence on gas this winter has driven consumers price spikes with electricity reaching $7000 per MWh due to infrastructure constraints on gas fuel supplies. This figure is sharply different than EPA's expected $70 per MWHr.

Similarly, reliance on EIA forecasts that no coal plants will be built in any event is precarious. EIA forecasts are a snapshot based on a set of assumptions and have consistently failed to see market fluctuations and interruptions. They are in fact revised annually and sometimes more frequently. We point to the EIA assumption of gas at $4.50 per mmBtu through the decade and prices have already risen in recent months to $5.50- 6.50 per mmBtu and sometimes higher.

Alstom is a leading global developer of carbon capture technology. The true state of the technology (setting aside 1-5MW pilots) is that today there has been one 40 MW capture unit at AEP's Mountaineer Plant (since shut down), one 35 MW capture plant at Southern Company's Plant Barry (still in operation) on coal; there are two small pilots in early development in Mongstad, Norway on natural gas and refinery gas. This is the essentially the extent of the largest current capture technology with sustained operation on conventional power plants. DOE is participating in a number of projects cited by EPA in its text which are about or nearly demonstration size that are all estimated to start between late 2014 and 2018. Alstom would point out the recent report by the Congressional Research Service (Carbon Capture and Sequestration (CCS): A Primer, Peter Folger, Specialist in Energy and Natural

Resources Policy; May 14, 2012), which calls into question whether all or any of these will become fully operational.

Alstom's view is that while carbon capture technology has been proven to work, the industry has yet to reach demonstration stages to reduce the cost and reduce the risk of scaling these technologies from pilot or validation scale to full scale. Thus Alstom would challenge EPA on the argument that Carbon Capture is available and adequately demonstrated. In our view without full scale demonstration, the technology should not be considered for deployment across the industry or for application as NSPS or best system of emission reduction as the industry is not in a position to make proper commercial warranties and guarantees as required...

Technology Scale-Up and Integration

EPA indicates it has done literature searches and reviewed other sources of information to determine that all the components of CCS are available. However, an important point EPA misses is that the true risk in any complex multi-stage process such as CCS is the scale-up and integration of the components. The risk is defined when at scale you need to deal with integration issues such as:

- How does the capture process turn down with generation load;
- What is the potential impact on generation if the capture plant is dependent of the steam load of the generator;
- What happens to compression when load on the capture plant is reduced and does that subsequently impact transportation or injection given instantaneous load drop and increase;
- How will volumes of water and byproducts from impurities in the flue gas be handled and will they effect injection; and

- What is the risk associated with shutting down generation when the capture or subsequent processes fail?

The list goes on but the point is these all create risks which need to be understood by scaling up and performing demonstrations. This has been reflected in the current market by two of the EPA projects having to be financed internally and with the generator accepting the risks (not normal in the power industry) and in two other projects where financing by US financial institutes does not exist and the projects have had to seek financing arrangements outside the US. This truly reflects that CCS is not ready to be mandated for deployment. EPA's arguments are similar to a statement that since all car components are known, everyone can build their own car and there is no need for companies that assemble and guarantee cars.

Customer Guarantees

Alstom would also point out that it is unaware that any supplier of this technology is ready or able to offer commercial guarantees for such full-scale systems of carbon capture. All utility generators require extensive performance guarantees and warranties which cannot be offered without proper demonstration at scale. All the projects that form a basis for the EPA rule would require extensive revenue sources from niche market opportunities like EOR and chemicals and large federal subsidies. None would stand alone on a common commercial basis. This would in turn mean that no new coal burning plant could be permitted or financed. Hence it is unlikely that such systems will be available prior to the EPA obligatory eight-year review of this proposed NSPS.

CCS Technology Roadmap

Alstom would also point out that DOE has developed a comprehensive roadmap and timeline for the commercialization of CCS technologies which ultimately points to

general deployment around 2020; although the timeline for commercial deployment cannot be clearly defined until there is full scale demonstration. After the first generation technology has been demonstrated at scale, the hope is second generation technologies can reduce costs, although they will not have been demonstrated at that time. This timeline, if embraced by EPA, would set CCS aside until the EPA suggested eight-year review of NSPS, thus avoiding conflict between agency visions.

By simply requiring all technologies be the highest possible efficiency (such as Ultra Super Critical technology), this proposal would promote the policy of having the best available technologies to replace the older less efficient existing fleet. It also would be a good transition for the existing fleet. Alstom has estimated that using best efficient technology and then upgrading the existing fleet, the industry can combine to exceed proposed targets for reduction in CO2 prior to 2020 and the next NSPS review.

Alstom would also take one further exception to the position that this rule would incent the development of CCS. Our view of the market and industry is that public utility commissions and regulators are struggling to maintain the lowest cost of electricity to ratepayers. Consequently, in today's market of moderate natural gas prices, , it is very unlikely that any commission will allow the recovery of development costs on existing plants based on a new plant rule that allows uncontrolled natural gas alternatives that are obviously less expensive. Without the ability to find cost recovery or government subsidies, it will not be possible to reach demonstration scale critical to the successful adoption and application of the CCS technology by generators and gain acceptance by the financial community that are necessary to achieve significant carbon reductions..

In conclusion, we believe the failure to meet the Clean Air Act criteria should prompt EPA to reconsider crafting carbon control regulations more in line with the technology development and DOE timeline.

Thank you for the opportunity to present this testimony...

CAREER PROFILE

Robert G. Hilton
Vice President,
Power Technologies for Government Affairs,
Alstom Power Inc.

In his current role, Robert (Bob) Hilton provides information and technical data on power technology to state and federal regulators. During more than ten years with Alstom, Bob has held several positions of increasing responsibility including Vice President of Marketing for Alstom's global Air Pollution Control business, Vice President of Research & Development in air pollution control; Vice President of Alstom's Post Combustion Carbon Capture Programs; Director of Business Development; and Strategic Development Director.

Today, Hilton is responsible for providing technical guidance on regulatory and legislative issues for Alstom and providing testimony to committees supporting Alstom's positions. He represents the Company in technical organizations, work groups and industry associations to process the Company's regulatory agenda and interfaces with state and federal officials to provide information on key issues. Additionally, Hilton provides guidance and input to the strategic and operational planning of the Alstom US business with regards to regulatory issues.

Hilton has been in the air pollution control field for over thirty years. His specialty is air pollution and the related issues of water and waste management. He holds a B.S. in Chemistry from Philadelphia College of Textiles and Science, a MBA in Finance, from Drexel University, Philadelphia and is past president and a member of the Board of Directors, Institute of Clean Air Companies. He is also the inventor of 15 US and foreign patents and applications and has authored numerous technical publications.

Testimony
Technology Requirements for Meeting the New Source Performance Standards for CO_2 from Electric Generating Units:

Technical Insights from EPRI on CO_2 Storage

U.S. House of Representatives
Committee on Science, Space and Technology
Subcommittee on Environment
Subcommittee on Energy

Robert C. Trautz
Senior Technical Leader
Electric Power Research Institute
March 12, 2013

My name is Robert C. Trautz. I am a Senior Technical Leader in the Generation Sector at the Electric Power Research Institute (EPRI, www.epri.com). EPRI conducts research and development relating to the generation, delivery, and use of electricity for the benefit of the public.

As an independent, nonprofit corporation, EPRI brings together its scientists and engineers, as well as experts from industry, academia, and government, to help address challenges in electricity, including reliability, efficiency, health, safety, and the environment. EPRI also provides technology, policy, and economic analyses to drive long-range research and development planning, and supports research in emerging technologies including Carbon Capture and Storage. EPRI's members represent more than 90 percent of the electricity generated and delivered in the United States, and international participation extends to 40 countries. EPRI's principal offices and laboratories are located in Palo Alto, California; Charlotte, North Carolina; Knoxville, Tennessee; Washington, D.C., and Lenox, Massachusetts.

EPRI is working closely with the U.S. Department of Energy and the Southern States Energy Board (SSEB) under the Southeast Regional Carbon Sequestration (SECARB) partnership program to assess CO_2 storage opportunities in the southeastern United States. It is with the support of the SSEB and SECARB partnership that I appear before you today

EPRI appreciates the opportunity to provide this testimony to the subcommittees..

Putting CO_2 Emissions and Storage into Perspective

The proposed rules for the New Source Performance Standard (NSPS) places limits on CO_2 emissions from new fossil fuel-fired electric generating units (EGUs) that will significantly reduce CO_2 emissions and will have a profound impact on technology used to generate electricity in the future. At the heart of the proposed EPA rule is a mandatory reduction in CO_2 emissions intensity using carbon capture and storage (CCS) technology that will require EGUs that use solid fossil fuels like coal to reduce CO_2 emissions to less than 1,100 lb/MW-hr gross. To place this emission limit in perspective, the amount of CO_2 that will need to be captured and stored to meet the 1,100 lb/MW-hr gross emission limit is approximately 40% of the CO_2 output from a supercritical pulverized coal fired EGU. A relatively modest size 1,000 MW EGU will produce approximately 7.8 million metric tons of CO_2 per year, requiring that about 3.1 million metric tons of CO_2 be captured and stored per annum. For this example, the total CO_2 tonnage to be stored over a 40 year EGU life span will exceed 120 million metric tons.

To understand the significance of storing this quantity of CO_2, I offer the following storage example for illustrative purposes only:

Using the Lower Tuscaloosa Massive Sandstone located within the Gulf Coast region of the United States as a case in point, which was studied by the SECARB partnership in 2008-2009 and found to be a significant potential storage reservoir,[1] injection of 120 million tons of CO_2

[1] Advanced Resources International, Inc., Final Report Plant Daniel Project: Closure Report, Vol. 1, Prepared for the United States Department of Energy, National Energy Technology Laboratory, January 31, 2010

into this 210 ft thick regionally extensive saline reservoir at a depth of 8,500 ft would create a CO_2 plume with an surface area of over seven square miles.

This example illustrates that the footprint or area in the subsurface occupied by the injected CO_2 emissions from a single EGU will likely extend over many square miles. It also demonstrates the importance of characterizing and utilizing large regional reservoirs for storage due to the very large quantities of CO_2 from multiple EGUs.

What types of reservoirs are available for storage and what are their primary attributes?

The testimony that follows is intended to provide a basic technical understanding of CO_2 storage and the potential role that saline and depleted oil and gas reservoirs will play in meeting the Nation's storage needs. Note that geologists typically know more about oil and natural gas reservoirs because of related oil and gas exploration and production activities, but a number of reservoir types will likely have to be utilized to meet expected storage needs.

Saline reservoirs represent deep rock formations consisting of porous sandstones, limestones, dolomites, and coals (to name just a few rock types that can serve as storage reservoirs) that contain naturally occurring saline groundwater that is non-potable. Oil and gas reservoirs typically consist of the same porous sedimentary rock and often contain saline groundwater too. This is because oil and gas reservoirs are typically part of a much larger regional saline aquifer system. Oil and gas reservoirs contain geologic traps, structural features like folds or faults in the earth, where oil and natural gas accumulate over geologic time. Reservoirs that contain natural traps represent the best storage reservoirs because they are likely to have high potential for retaining stored CO_2. "Depleted" oil and gas reservoirs refer to the fact that the reservoir has undergone production of oil and natural gas, resulting in the depletion or reduction in fluid pressure below initial reservoir conditions that occurs when oil and natural gas are extracted from the reservoir.

It is important to note that fluids, whether oil, natural gas, saline groundwater or CO_2, move through and occupy the voids or pore spaces in the rock. Earth scientists use the term formation or rock permeability to describe the ease at which fluids move through the rock pores. Porosity is an important property that describes how much space or pore volume is available in the rock to store fluids including CO_2. Sandstone formations with high permeability and high porosity make excellent storage reservoirs because it is easy to inject and store CO_2 in these formations. Rocks like mudstone and shale that have low permeability and low porosity make excellent caprocks, which keeps the CO_2 contained within the storage reservoir.

The Department of Energy estimates that there are approximately 226 billion metric tons of CO_2 storage capacity in depleted oil and gas fields and between 2,102 to 20,043 billion metric tons in saline formations in the US and Canada.[2] The stark contrast in these storage estimates illustrates the importance of saline reservoirs. The range of values provided for saline storage capacities reflects the fact that geologists don't know as much about these types of reservoirs and, therefore, the capacity values have greater uncertainty.

[2] Carbon Sequestration Atlas of the United States and Canada, 4th Ed., U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, 2012.

Depleted oil reservoirs that have undergone primary and secondary production are attractive targets for CO_2 storage for several reasons:

- They typically contain known traps that have stored oil for millennia if not millions of years. By analogy, they are expected to hold CO_2 for a similar geologic time scale
- The reservoirs are well characterized because of oil exploration activities; however, important reservoir properties (permeability and porosity) are typically known only for the oil-bearing layer
- Additional storage capacity is available due to the removal of oil and brine during production
- Reservoir pressures are typically lower than the original reservoir pressure, allowing more CO_2 to be injected at higher injection rates

Depleted gas reservoirs share many of the same attributes as depleted oil reservoirs, including the fact that the traps have stored natural gas over geologic time.

Depleted oil and gas reservoirs also create some challenges in that the numerous well penetrations in the oil and gas field create potential conduits for CO_2 migration and leakage into shallower zones if the wells are not properly plugged and abandoned.

The potential use of depleted oil and gas reservoirs for CO_2 storage could be adversely affected by potential regulatory requirements associated with CO_2 storage. Preliminary feedback from oil producers indicates that a requirement for EOR operators to monitor a storage facility and certify that the CO_2 is stored under Subpart RR of the EPA's mandatory greenhouse gas reporting program, could be a risk that companies may not be willing to accept. Thus, such requirements may have the unintended consequence of discouraging the use of depleted oil and gas reservoirs. It is apparent, however, that the limited geographic distribution and storage capacity of oil and gas reservoirs will, in any case, eventually limit their long-term use.

One of the benefits of using depleted oil and gas reservoirs for CO_2 storage is the wealth of geologic knowledge available for these reservoirs. In contrast, little is known about saline reservoirs because there has been little incentive to explore these types of reservoirs since they currently have little to no economic value. Disposal of liquid industrial and municipal wastes into saline reservoirs represents their single biggest use. Even in oil and gas provinces where wells are numerous, oil and gas operators will not typically characterize saline reservoirs because of the added cost of doing so. Therefore, data on saline reservoirs is typically lacking and may be limited to geologic descriptions from drilling logs.

Unlike depleted oil and gas reservoirs, which have undergone production and decline in reservoir pressure, saline reservoirs have relatively high starting pressures, which have the following implications:

- Injection pressures and rates may need to be lower to prevent over-pressuring the reservoir and fracturing the caprock, potentially requiring more wells and infrastructure costs;

- Saline water extraction and management may be required to lower pressures in the reservoir adding to the cost of storage, but perhaps providing an alternative source of water if treated;

What is the status of saline storage?

To date, there are only three large scale saline storage projects in the world that have (or are currently) injecting CO_2 at a rate approaching one million metric tons per year. It is important to note that each of these projects involves CO_2 separation from a natural gas stream and the annual amount stored per site is a third of the CO2 that would be stored by a single 1,000 MW coal-fired EGU as described at the beginning of this testimony. None of these projects involve the engineering, design and operational experience needed to optimally integrate an advanced coal-fired power unit with a full-scale capture, transport and storage facility to maximize system performance. However, from a geologic storage perspective, the following large-scale saline project experiences are relevant and very important for the following reasons:

- The Sleipner natural gas project operated by Statoil in the North Sea (Norway) is the flagship of the global CO_2 saline storage projects. Due to the immense size and high permeability of the sub-seabed storage reservoir at this location, the Sleipner project has been able to inject CO_2 at a sustained rate of 1 million metric tons for nearly twenty year (since 1996).
- The Snohvit natural gas project, another offshore CO_2 storage project operated by Statoil in the Barents Sea (Norway), started injecting CO_2 in 2008. However, the project immediately found that the permeability of the target formation was to low and pressures climbed rapidly, requiring mitigation. Fortunately, multiple stacked reservoirs[3] gave Statoil the flexibility to select another injection interval, allowing the project to continue injecting at a sustained rate of ~820,000 metric tons per year.
- The In Salah natural gas project, located in central Algeria, is an onshore project operated by British Petroleum. Approximately one million metric tons of CO_2 was injected per year into three horizontal wells starting in 2008. The project suspended injection in 2011 after monitoring data and supporting analyses indicated that the lower 650 ft of the 3,120 ft thick caprock above the storage reservoir had likely fractured due to CO_2 injection pressures.[4]

It is important to note that although the In Salah project is no longer injecting CO_2, the CCS community still views this early saline project as a success because the monitoring program served its intended purpose. That is, the monitoring methods deployed at the site informed the operator of a potential problem, leading to a shutdown of CO_2 injection before the caprock was breached.

[3] Multiple layered reservoirs at the same location, which geologist referred to as stacked reservoirs or stacked storage, are ideal because it offers multiple injection layers and greater operational flexibility compared to a single layer.

[4] White, J. A., L. Chiaramonte, S. Ezzedine, W. Foxall, Y. Hao, W. McNab, and A. Ramirez, In Salah CO_2 Storage Project, Lawrence Livermore National Laboratory, Project Number: FWP-FEW0174 Task 2, presentation at theU.S. Department of Energy, National Energy Technology Laboratory, Carbon Storage R&D Project Review Meeting, August 20-22, 2013

Of noteworthy importance, is the Gorgon LNG Project off the northwest coast of Western Australia, which is scheduled to begin injecting CO_2 in 2015. The natural gas processing facility will inject 3.4 to 4 million metric tons of CO_2 per year into a saline formation. A total of 120 million metric tons of CO_2 will be injected over the project's 40 year lifetime, representing 40 percent of its emissions. CO_2 emissions produced by the Gorgon project is equivalent to the 1,000 MW EGU case described earlier.

CO_2 Storage Research

The Department of Energy (DOE) has played a pivotal research role in the US and abroad by designing and managing a CO_2 storage research program that is applied and focused on developing monitoring and analytical tools that industry can use to implement CCS projects. DOE's research approach includes regional mapping of saline, oil and gas and coal-seam reservoirs and a nation-wide assessment of their CO_2 storage capacity that industry can then use to identify and screen potential storage sites. DOE has and is currently fielding demonstration projects involving CO_2 injection ranging from a few hundred tons to 250,000 tons per year to develop the experience base and tools needed to successfully deploy CCS. Additional demonstration projects are planned that would involve injecting one million metric tons of CO_2 per year. The Regional Carbon Sequestration Partnership program, Industrial CCS program and Clean Coal Power Initiative are key DOE demonstration programs.

Given the fact that the NSPS is clearly focused on reducing emissions from fossil fuel-fired EGUs, continued DOE investment in future research involving capture and saline demonstration projects that are fully integrated with advanced power generating systems is needed and would be invaluable to the power industry. Only two of the demonstration projects in DOE's research portfolio fielded to date have involved slip stream capture of a relatively small amount of CO_2 from two power stations with corresponding injection into saline reservoirs of 37,000 and 100,000 metric tons. These include the injection projects performed at American Electric Power's Mountaineer power station in West Virginia and the Alabama Power Company's Plant Barry power plant in Alabama supported by EPRI. The FutureGen2 project located near Meredosia Illinois is a commercial scale oxy-combustion power system that will produce 1.1 million tons of CO_2 emissions each year. Currently in the planning stages, if the DOE-supported FutureGen2 project progresses, it will be the first full-scale EGU involving CO_2 saline injection in the United States.

Summary

The CCS community recognizes that we will likely turn to saline reservoirs for our large-scale, long-term CO_2 storage needs because of their wide spread distribution and large storage capacity. The potential use of depleted oil and gas reservoirs for CO_2 storage could be adversely affected by potential regulatory requirements associated with CO_2 storage and could have the unintended consequence of accelerating the move to saline storage. Given that more is known about oil and natural gas reservoirs because of their commercial value, future government storage research and funding may need to focus disproportionately on characterization of saline storage reservoirs to help close the knowledge gap. This would help facilitate deployment and hasten the transition to saline storage.

The Sleiper, Snohvit, and In Salah projects described earlier provide invaluable learning experiences. More importantly, these projects illustrate the risks associated with storage and geologic uncertainty associated with selecting a saline storage site. The projects also illustrate our need to rapidly expand our experience base to scales that are commensurate with full-scale commercial power projects. With experience comes greater technical certainty and operational reliability upon which sound financial investment decisions can be made. Further government investment in research is needed that will integrate fossil fuel-fired power projects with capture and saline storage at full scale to demonstrate that the technology is feasible and reliable. By doing so, it can reduce operational and financial uncertainty.

Thank you for the opportunity to testify before you today and I welcome your questions.

Robert C. Trautz

Mr. Trautz is a Senior Technical Leader with the Electric Power Research Institute (EPRI) in Palo Alto, California. He has 30 years of experience in research and applied geology and hydrology involving CO_2 storage, radioactive-waste disposal, and groundwater remediation. Mr. Trautz received a Bachelor of Science degree in Geology from Michigan State University in 1981 and a Master of Science in Hydrology from the University of Arizona in 1984.

Mr. Trautz is responsible for identifying key policy and technical issues related to geologic storage of CO_2, developing the EPRI geologic storage research program in consultation with EPRI utility members, establishing funding priorities and direction, and managing the research effort.

Mr. Trautz manages and serves as the technical leader for several CO_2 storage field demonstration projects funded by the U.S. Department of Energy (DOE), EPRI and/or industry. The overall goal of these field projects is to demonstrate safe, reliable geologic storage of CO_2. Specific demonstration project experience includes the:

- West Coast Regional Carbon Sequestration (WESTCARB) Arizona Utilities CO_2 Storage Project (2005–2010) designed to explore CO_2 storage opportunities in northern Arizona
- Southeast Regional Carbon Sequestration (SECARB) Mississippi Saline Test (2005–2009) – small scale, 3,000 ton injection of CO_2 into the Lower Tuscaloosa sandstone at Plant Daniel, Mississippi
- SECARB Anthropogenic Pilot Test (2008–2017) – the project has captured over 100,000 metric tons of CO_2 from Plant Barry and stored it in the Paluxy saline formation near Citronelle, Alabama
- AEP Mountaineer Project (2010–2012) – served as an EPRI advisor for the 37,000 CO_2 ton storage project at the Mountaineer Power Station, West Virgina
- Distributed Fiber Optic Monitoring Project (2013–2016) – Principal Investigator for this innovative project designed to use fiber optic sensor arrays for monitoring CO_2 storage sites

Prior to joining EPRI in late December 2007, he worked at Lawrence Berkeley National Laboratory (1997-2007), Environmental Science & Engineering (1990-1997) and the U. S. Geological Survey (1987-1990) in different capacities.

Hearing of the House Subcommittee on Environment and Subcommittee on Energy of the Committee on Science, Space, and Technology

Written Statement of Scott Miller
General Manager of City Utilities of Springfield
On Behalf of the American Public Power Association
March 12, 2014

Dear Chairmen Schweikert and Lummis and Ranking Members Bonamici and Swalwell, thank you for the opportunity to speak at today's hearing to explore the technological requirements for meeting the newly proposed New Source Performance Standards (NSPS) for emissions of carbon dioxide (CO_2) for electric generating units (EGUs). My name is Scott Miller and I am the General Manager and Chief Executive Officer of City Utilities of Springfield (City Utilities). I am also a member of the Board of Directors of the American Public Power Association (APPA). I am testifying on behalf of my utility and APPA.

City Utilities is a municipal utility that provides electric, natural gas, water, broadband, and transit services to the Springfield area. We serve a population of over 222,000 and have generation capability over 1,100 MW, which includes a mix of fossil and renewable sources. In addition, CU is developing Missouri's largest solar farm.

City Utilities is a member of APPA, the national service organization representing the interests of over 2,000 community-owned, not-for-profit electric utilities. These utilities include state public power agencies, municipal electric utilities, and special utility districts that provide electricity and other services to over 47 million Americans, serving some of the nation's largest cities. However, the vast majority of APPA's members serve communities with populations of 10,000 people or less.

Overall, public power utilities' primary purpose is to provide reliable, efficient service to local customers at the lowest possible cost, consistent with good environmental stewardship. Public power utilities are locally created governmental institutions that address a basic community need: they operate on a not-for-profit basis to provide an essential public service, reliably and efficiently, at a reasonable price.

APPA commends you for holding a hearing exploring the technological requirements for CCS for new fossil fuel-fired power plants. Public power utilities are concerned about the potential or likely impacts of the Environmental Protection Agency (EPA) regulating CO_2 emissions from new power plants by establishing NSPS under the Clean Air Act. The agency's September 20, 2013, re-proposed rule concludes that CCS is the best system of emissions reduction (BSER) adequately demonstrated to reduce CO_2 emissions.[1] APPA strongly disagrees

[1] For the re-proposed NSPS, EPA applied a four-part test to determine BSER. First, is the system of emissions reduction technically feasible? Second, are the costs of the system reasonable? Third, what amount of emissions reductions will the system generate? Fourth, does the system promote the implementation and further development of technology? See p. 25 of Proposed Rule: Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 1430 (Jan. 8, 2014), Docket - EPA-HQ-OAR-2013-0495.

with EPA's conclusions about the commercial demonstration of the technology and believes the agency has failed to look at a variety of issues related to the long-term sequestration of CO_2. Until these issues are addressed, it is premature to require the use of CCS by new coal-fired power plants.

I. EPA's Conclusion That CCS Is Adequately Demonstrated Is Premature.

The re-proposed NSPS would require new coal-fired power plants to achieve an emissions limit of 1,100 pounds of CO_2 per megawatt/hour (lbs CO_2/MWh) (gross) based on a 12-month rolling average compliance period. In the alternative, coal-fired power plants could achieve an emissions limit between 1,000-1050 lbs CO_2/MWh (gross) based on an 84-month rolling average compliance period. Use of CCS technology would be required to meet either standard. Natural gas units with a heat rate greater than 850 MMBtu/h would be subject an emissions limit of 1,000 lbs CO_2/MWh (gross) and need no additional control technology to reduce emissions.

In justifying the use of CCS, EPA modified its definition of the BSER in a manner that promotes newly emerging technologies, such as CCS. The agency asserts that BSER can be technology forcing and consider "the impact a standard will have on further technology development." While the re-proposal acknowledges that there are no commercially operating coal-fired power plants using CCS, the re-proposal asserts that four demonstration projects under development in the U.S. and Canada adequately demonstrate CCS at commercial scale. EPA never addresses the fact that there is no commercial demonstration of sequestration in non-oil and gas recovery locations. Nor does the agency address the myriad of regulatory hurdles impeding the sequestration of CO_2 in the U.S.

A. EPA's Assertion That It Only Needs to Find Carbon Capture, but Not Sequestration Adequately Demonstrated and Achievable Is Erroneous.

EPA looked at three technologies to reduce CO_2 emissions from fossil fuel-fired power plants: (1) super critical pulverized coal (SCPC); (2) total CCS (defined as capturing more than 90 percent of emissions); (3) "practical" CCS (not defined, but implicitly less than 90 percent capture). Comparing the emissions reductions from the three technologies, the agency concluded that partial CCS was BSER because the emissions reductions "that would result from an emissions standard based on SCPC or Ultra Super Critical Pulverized Coal (USCPC), or even IGCC, "would not be consistent with the purpose of CAA Section 111 to achieve 'as much [emission reduction] as practicable.'"[2]

Notably, the proposed NSPS is called partial CCS, but the standard itself is defined solely for purposes of compliance as carbon capture. Nonetheless, throughout the NSPS proposal, there are disjointed discussions of the availability and achievability of both carbon capture and sequestration. Recently, agency officials have emphasized, however, that the agency need only demonstrate the adequacy and achievability of carbon capture. For example, during EPA's Science Advisory Board (SAB) review of the proposed standard in December 2013 and January 2014, the Administrator and other EPA officials underscored that since compliance with the proposed NSPS was limited to carbon capture, the SAB's review of the proposed BSER was

[2] *Id.*

likewise limited to the scientific and peer review issues regarding "carbon capture" (1,100 lb. CO_2/MWh), not sequestration of the CO_2 captured. These assertions, which are repeated in various places in the Notice of Proposed Rulemaking (NPRM),[3] appear to be intended to justify the technical and legal basis for claiming that carbon sequestration has been adequately demonstrated and achievable.

B. None of the Projects or Historical Enhanced Oil Recovery (EOR) Experience EPA Relies Upon Provide a Sufficient Basis to Conclude CCS Is BSER.

EPA asserts that partial CCS is "adequately demonstrated" based on the operation, construction, and/or development of pilot CCS projects at four base load and intermediate load fossil fired EGUs. The pilot projects are Southern Company's Mississippi Kemper Station, SaskPower's Boundary Dam operation, the Texas Clean Energy Project, and the Hydrogen Energy California project. In addition, EPA relies on historic enhanced oil recovery (EOR) operations and terminated international CCS projects as proof that CO_2 sequestration is adequately demonstrated. These characterizations are simply misleading because CCS is not operational, development of the projects is reliant on huge government subsidies, and at least one has been suspended for various technical and financial reasons.

While CO_2 has been recycled in the oil and gas sector for almost forty years, the idea of permanently sequestering it is novel. CO_2 gas functions like a solvent to move oil and gas more effectively than water flooding. The CO_2 currently used in the oil and gas sector in the U.S., Norway, Australia, and Canada is recycled, not permanently stored. Recycling of the gas is far different than permanently storing it underground for thousands of years. The oil and gas sector typically stores the gas for days, weeks, and sometimes months, and usually removes and transports it by specialty pipeline for use at the next oil and gas recovery location.

C. To Date, No CO_2 Has Been Injected and Sequestered at Any of the Cited Demonstration Projects.

None of the four pilot projects described in the NPRM actively capture CO_2 from plant exhausts or sequester CO_2 in the ground. Of the four, two are in the process of being constructed and two are in development. Of the two being constructed, the Kemper plant faces development costs in excess of $1 billion,[4] and is dependent on a technology development for a lignite coal that is not available any other place in the country. The second plant under construction, in Canada, is a post combustion CCS operation at a small research facility boiler that is not scalable.

Of the two projects still in development, there is no firm timeline for construction of either. The California polygeneration project is not expected to get its construction permit for another nine months and then the construction itself will take almost four years. Thus, CO_2 will not be injected in the California project for at least four years, at the earliest. The Texas project, which is not operational, has been unable to secure a purchase power contract from an electric utility and thus the project has been suspended.

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[3] *Id*. at 1483/column 3.

[4] Southern Co.: Kemper Plant Construction Cost Could Grow by $40M, Mississippi Business Journal, January 29, 2014, available at http://msbusiness.com/blog/2014/01/29/southern-co-kemper-plant-construction-cost-grow-40m/.

Since CCS is not operational at these pilots, there is no data about their continuous operations, whether the technology can be scaled to commercial operations, or the cost of that technology. Therefore, these pilots cannot form the basis for a finding that the technology is available. EPA is violating the law by making assumptions about a future, theoretically possible technology.

There also is no mention in the NPRM of the inability to complete three CCS pilot projects by public power utilities in Jamestown, New York, Holland, Michigan, and southern Missouri that were discontinued when captured carbon was not feasible for a variety of reasons. City Utilities was actively involved in the Missouri Carbon Sequestration Project. Our experience highlights just some of the issues that need to be addressed before CCS technology can be declared adequately demonstrated.

II. CU's Experience with the Missouri Carbon Sequestration Project.

In 2005, a group of Missouri generating utilities gathered to discuss how CO_2 emissions could be managed if future regulations were imposed. At the time, over 70 percent of electricity provided in the state came from coal-fired generation. It was also becoming apparent that much of the carbon storage research was not addressing geologic conditions found in Missouri. To address this gap in research, City Utilities, Kansas City Power & Light, The Empire District Electric Company, Ameren Missouri, and Associated Electric Cooperative entered into a cooperative agreement with the Department of Energy's National Energy Technology Laboratory (NETL) to research the sequestration of CO_2 in several formations in Missouri.

The project, entitled the Missouri Shallow Carbon Sequestration Demonstration Project, was funded by Congress in two appropriations in fiscal years 2008 and 2010 totaling $4.7 million. Missouri's generating utilities provided a matching share of approximately $1.2 million. CU recently concluded its research activities related to the project.

The purpose of the project was to evaluate the feasibility of on-site carbon sequestration at power plants in Missouri. The project is called shallow carbon sequestration because the target sandstone formation was believed to be at approximately 2,000 to 3,500 feet below the surface. Most sequestration research is directed toward geologic basins at a depth on the order of 10,000 feet. At the shallower depth, CO_2 injection and storage would be in the gas phase, as opposed to liquid, also referred to as supercritical phase, which occurs at greater depths.

The original plan was to drill injection and monitoring wells and inject small quantities of food grade CO_2 to test the ability of the target formation to receive that CO_2. A later monitoring phase was planned to determine the ability of the formation to hold the CO_2 in place for a period of ten or more years. The research was conducted by project partners Missouri State University, Missouri University of Science and Technology, and the Missouri Department of Natural Resources. The project included laboratory analysis of core and water samples, development of hydrogeologic models, bench scale testing of permeability, porosity, and chemical interactions, and downhole testing of geophysical properties.

Some of the project's original objectives were achieved, but ultimately we were not able to substantiate our ability to sequester CO_2 within the state. The site identified for exploration was at City Utilities John Twitty Energy Center, the location of our two largest coal-fired power units with a combined capacity of approximately 500 MW. Drilling and coring proceeded to a depth of 2,186 feet to the Precambrian basement rock. However, the planned injection of CO_2 was not possible. Water quality analysis in the target formation found the Total Dissolved Solids well below the Safe Drinking Water Act standard of 10,000 mg/L, thus precluding injection under federal regulations.

Laboratory testing of core samples did allow an estimate of carbon sequestration potential. Based on a presumed 800 m x 800 m reservoir, a total CO_2 storage capacity of 2.55×10^5 metric tons over 15.8 years was calculated. This would represent about 1 percent of the CO_2 production at John Twitty Energy Center during normal operations during that time frame. In other words, should sequestration have been possible, it would require over 100 wells or well fields, at a conservative cost estimate of $1 million per well, to attain this level of storage capacity, if actual injection corresponded to laboratory test results.

The project was then modified to redirect funds to perform drilling and testing, to the degree funds would allow, at the other partner locations around the state. A second borehole was located at Associated Electric's Thomas Hill Energy Center in North Central Missouri. Basement was encountered at 2,540 feet. Water quality at the target formation was sufficiently saline to permit injection. As at Springfield, the confining layer was found to be effective. Laboratory testing demonstrated reservoir capacity approximately five times greater than Springfield.

The third site was located at Kansas City Power & Light's Iatan Generating Station. Drilling was completed to a depth of 2,090 feet, but due to time and material limitations, the basement rock level was not achieved, nor was core collected.

The fourth site was near an Ameren Missouri plant location south and west of St. Louis. Depth of the target formation was significantly greater than anticipated. Drilling was terminated at 3,625 feet due to physical limitations of the drilling equipment, before reaching Precambrian basement rock. Again, the confining layer and water quality were found to be acceptable for injection. Additionally, the depth of the target formation suggested that super-critical injection might be possible. Gas phase storage was calculated at approximately twice that of Springfield.

In summary, approximately $5.8 million of testing revealed one site where water quality would not permit injection, and we identified two other sites where further testing might be considered. The confining layer analysis was one of the major successes of the project. The project partners were able to identify that the confining layer in three of the locations appear to be adequate to contain CO_2 on the aquifer. Originally planned pressure testing and aquifer permeability had to be abandoned due to cost limitations, so no CO_2 test injections were performed. While some target formation storage capacity was calculated based on laboratory testing, we were not able to demonstrate the long-term storage capability.

Based on the results of the project, it is not clear to City Utilities that CCS technology is a realistic option for utilities seeking to reduce their CO2 emissions from fossil fuel-fired power plants in the near term. As the CEO of a municipal utility, I have an obligation to the city and our customers to spend their money wisely. I cannot tell customers that I would have a degree of confidence that CCS would work.

Looking at all CCS research conducted to date, there appears to be no factual basis on which EPA may assert that carbon sequestration technology has met the Clean Air Act's three-part test for BSER. Sequestration technology has been not adequately demonstrated. It is not widely available and has not been shown to be technically and economically feasible.

III. EPA Failed to Assess the Non-Air Public Health Environmental Impacts in Determining that Partial CCS Is BSER.

Clean Air Act Section 111(a) requires EPA to select a standard of performance that:

> [R]eflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.

EPA's preferred NSPS option for coal-fired EGUs—partial CCS—fails to assess or discuss the "non-air public health and environmental impacts" of the technology. The proposed regulation does so by defining CCS as "carbon capture" (i.e., the "s" is silent). Agency protestations that the "non-air environmental effects" of sequestration either do not need to be examined or were examined in a recently issued Class 6 Underground Injection Control (UIC) permit rulemaking[5] are unavailing. The failure to examine non-air environmental consequences of CCS is a blatant violation of the letter and the spirit of the Clean Air Act and the public's trust. EPA's proposed NSPS for fossil fuel-fired EGUs could create an imminent harm of transferring air pollution to other environmental media, not dissimilar to man's disposal of wastes in much of the 19th and 20th Centuries without consideration of the potentially profound human health and environmental damages that would result.

Below are some of the issues the agency failed to address in its BSER determination. These include issues outside the scope of the Clean Air Act.

Hazardous Substance and Superfund Implications for Environmental Releases. EPA has not affirmed whether injection and sequestration of CO_2, an acid gas, is safe in non-oil and non-gas recovery locations. The agency needs to consider whether an acid gas would have the potential to change the pH of soil or, if released into the environment, whether it poses a potential threat to health or the environment. If acid gas injections have the potential to trigger remediation under the Community Emergency Response, Compensation, and Liability Act (CERCLA) (also known as the Superfund Act), then clearly the technology cannot be demonstrated.

[5] 79 Fed. Reg. 350 (Jan. 3, 2014).

Surface Water Contamination. There are increasingly significant questions regarding surface water quantity and quality raised by partial CCS. These involve the substantial quantities of water used in the injection process and the effect of large amounts of compressed gases on groundwater and surface water movement. Also, it is well understood within the agency's water office that seasonal surface water flow is very much affected by hydraulic heads in various groundwater aquifers. Altering these pressure gradients can cause numerous human health and environmental impacts, none of which have been studied by EPA in the context of permanently disposing vast quantities of compressed gases. They are, however, dramatically demonstrated by unprecedented water shortages currently being experienced in western and plains states. APPA believes that these "quantity" issues, ironically, could be exacerbated by the proposed BSER solution, particularly in western states experiencing drought conditions.

Moreover, there is tremendous potential for CCS to interfere with access to water in western states. For example, EPA has not taken into consideration the fact that subsurface western water rights are often depth restricted. Other physical consequences for drinking water, such as changes in hydraulic heads pushing water toward or away from groundwater wells and surface waters, must be closely analyzed and peer-reviewed.

Navigable Waters and Surface Water Flow. Given that EPA is considering policies affecting waters of the United States in another proceeding, it should also examine the consequences of subsurface CO_2 sequestration on "navigable waters" that support a variety of commercial and ecological interests. The agency needs to examine whether there is any chance that subsurface locations where CO_2 is sequestered could later be declared navigable waters.

Endangered Species Act (ESA): There is nothing in the record indicating that EPA has consulted with the U.S. Fish and Wildlife Service (FWS) under Section 7 of the ESA to determine whether sequestration of CO_2 into deep saline aquifers is permitted. Many deep saline aquifers run either through or under ESA's Habitat Conservation Plans, Conservation Banks, and Safe Harbor Agreement sites. While EPA may not be *required* by the CAA to consult with FWS in this specific rulemaking, permit applicants for federal CAA construction permits have to do so.

As U.S. Court of Appeals for the D.C. Circuit Judge Leventhal reminded EPA in *Portland Cement v. Ruckelshaus*[6] – shouldn't the agency be held similarly accountable? If not, how might these ESA-protected areas limit locations for sequestration? Has EPA or NETL attempted to reflect these limitations in its assessment or NETL's Carbon Sequestration Atlas,[7] which gives its prediction of potential geologic sequestration sites? The DOE Carbon Sequestration Atlas does not indicate areas with other environmental restrictions, such as National Parks, Wilderness Areas, etc., where sequestration of CO_2 might not be allowed. Very little mapping has been done of deep saline aquifers on the granular level required to actually predict CO_2 storage on a gigaton basis.

Land Planning: Little, if any, consideration has been given to the amount of land that is required for a commercial-sized operational partial CCS system. Such operations require at least

[6] 486 F.2d 375

[7] http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/

six square acres of surface space, almost inconceivable for most plants owned by public power utilities and many plants owned by investor owned utilities that were constructed between 1950-1970 near population centers and close to rivers and other water ways for cooling water and coal delivery.

Seismic Activity. Although EPA maintains that it has consulted the U.S. Geological Service (USGS) about seismic activity in the vicinity of EOR, agency officials have not sufficiently consulted with USGS regarding injection of CO_2 in non-oil and gas formations. Nor has the agency addressed specific concerns researchers have that are related to how quickly the CO_2 may be injected to maintain pressure in the rock. In addition, there is nothing in the record that shows that has EPA consulted with state departments of geology about their concerns with the vulnerabilities posed by injection of huge volumes of CO_2 under pressure, including potential earthquakes from hydraulic fracturing (HF). The agency is looking at these issues in its recent inquiry into seismic events for water injects in Oklahoma and Texas for natural gas production disposal wells. Why does it not also inquire and answer these questions in the context of geologic sequestration of CO_2?

In addition, EPA apparently assumes injection research efforts would be free based upon its assessment that the NSPS would have no research and development costs associated with each sequestration project. There are no projections on the cost of detailed acoustic and seismic readings in geologic locations where there is no extractive industry. The agency also appears to assume that there is no cost involved with the multimillion dollar subsurface studies needed in order to conduct permit applications under UIC Class V, Class VI, or Class II for injection of CO_2 by power plants. It is highly improbable that this data exists in the public domain or that it would be free. EPA needs to account for these costs and factor them into its analysis of CCS.

While the separation of CO_2 might be demonstrated, the sequestration of CO_2 is inherently location specific. This means that in each underground location, detailed acoustic readings and seismic assessments must take place by bonded, licensed, and experienced companies to determine the carrying capacity and injection rate into that rock formation for 30 to 50 years. These companies must also rule out any risks of inadvertent seismic events. The NETL Carbon Sequestration Atlas is informative, but offers no indicators of the carrying capacity or storage retention capacity of the listed geologic formations. That information is rock and location specific.

Natural Resource Depletion. EPA's proposed rule fails to identify the consequence of CCS on fossil fuel resources. What makes this glaring omission so troubling is that the record indicates that the agency consulted with the Department of Energy (DOE) and Energy Information Agency (EIA). Yet EPA and DOE apparently missed the very important concept that because CCS separation and injection technologies actually use more fuel with a parasitic power loss of about 30 percent at the plant, that coal-fired power plants (and natural gas-fired power plants with CCS, should that one day be required) will actually cause a hastening of the use of U.S. coal and natural gas. The depletion of fuel resources is equally a requirement of NEPA-like assessments.

Resolution of Underground Access and Trespass Issue. A question EPA has failed to address is how can a technology be demonstrated if it is not legal in all 50 states for a party to inject into and under the property owned by others? Many states do not have separate surface and subsurface land ownership. In most states, a property owner owns what is his land from the surface to "the heavens" and to the middle core of the earth. Only in extractive industry states are there separate ownership options to enable oil, gas, and hard/soft rock mining. Where there are no options for "mineral rights" ownership, the geologic sequestration of CO_2 that might migrate under another person's property is a legal trespass. This is a critical legal issue that has to be resolved before declaring that CCS is commercially demonstrated. Interestingly, all three of the U.S. CCS pilot projects are in oil and gas recovery operations and those states have mineral right ownership of the subsurface.

APPA has several papers and presentations that elaborate in more detail on the issues with CCS. A list of the documents and the links where they can be accessed is included at the end of this statement.

IV. EPA's Science Advisory Board (SAB) Questioned Whether the Agency Addressed Cross-Media Issues in Peer Review Regarding Geologic Sequestration.

On December 4 and 5, 2013, EPA's SAB raised concerns about the scientific and technological bases EPA relied upon when proposing to mandate CCS for NSPS for new coal-fired power plants. Specifically, the SAB expressed concern with the peer review process of the DOE studies that were relied upon in the proposed rule, how the agency came up with its emissions limits for new coal- and natural gas-fired power plants, and the fact that the proposed rule does not address the sequestration side of CCS. EPA responded to those concerns by asserting that regulatory mechanisms for addressing sequestration were outside the scope of Clean Air Act and thus do not need to be addressed in the NSPS for new fossil fuel-fired power plants. Agency staff stated that only the capture side of CCS needs to be addressed.

The SAB, in a letter to EPA Administrator Gina McCarthy, dated January 29, 2014, stated it "defers to EPA's legal view…that the portion of the rulemaking addressing coal-fired power plants focuses on carbon capture" because that is all that is within the scope of the Act. The letter notes, however, that "carbon capture is a complex process, particularly at the scale required under this rulemaking, which may have multi-media consequences." The board expressed its strong view that "a regulatory framework for commercial-scale carbon sequestration that ensures the protection of human health and the environment is linked in important systematic ways to this rulemaking." It encouraged EPA to have the National Research Council review the research and information on sequestration conducted by it, DOE, and other sources.

While SAB deferred to EPA's legal interpretation of its authority to look at cross-media issues rising from sequestration of CO_2, it is significant that the SAB raised these concerns. It is

clear that several members of the SAB agree with APPA that these issues need to be resolved before CCS is declared BSER.[8]

V. Conclusion

APPA believes it is premature to conclude that CCS is the BSER adequately demonstrated. While CCS may one day be a viable, economic, and commercially demonstrated technology utilities can use to reduce CO_2 emissions from power plants, it is not one they can use today or in the near future. There are a host of issues EPA has failed to look at related to the long-term sequestration of CO_2, including "non-air public health and environmental impacts" of CCS technology. The agency essentially equates sequestration with EOR. They are not the same. EOR is only available in parts of the country with oil and gas reserves and involves the recycling of CO_2 with no long-term storage. CO_2 captured from power plants in non-EOR areas will need to be stored for thousands of years. The results from the Missouri Shallow Carbon Sequestration Project show that further research is required before utilities can sequester CO_2 in the ground. And based on all CCS research conducted to date, there appears to be no factual basis on which EPA may assert that carbon sequestration technology has met the Clean Air Act's three criteria. Sequestration technology has been not adequately demonstrated. It is not widely available. Nor has it been shown to be technically and economically feasible. Until it has, EPA should reverse its determination that CCS is BSER.

[8] Per the request of the SAB, APPA sent a letter to it on December 9, 2014, outlining our concerns with the many obstacles to commercial demonstration of sequestration. The letter can be viewed at http://www.publicpower.org/files/PDFs/APPA%20Letter%20to%20EPA%20on%20SAB%20--%20FINAL%20--%2012-9-2013.pdf.

Carbon Capture and Storage Papers & Presentations Commissioned by APPA

L.D. Carter, White Paper, "Retrofitting Carbon Capture Systems on Existing Coal-fired Power Plants," November 2007 http://www.publicpower.org/files/PDFs/DougCarterpapernov07.pdf

L.D. Carter, White Paper, "Carbon Capture and Storage From Coal-based Power Plants: A White Paper on Technology for the American Public Power Association (APPA)," May 2007
http://www.publicpower.org/files/PDFs/Doug%20Carter%20-%20Carbon%20Capture%20and%20Storage%20From%20Coal.pdf

Doug Carter, Presentation, "Parasitic Power for Carbon Capture"
http://www.publicpower.org/files/PDFs/CarterParasiticower.pdf

Timothy Gablehouse, White Paper, "Geologic CO_2 Issue Spotting and Analysis" July 2009
http://www.publicpower.org/files/PDFs/GablehouseSequestrationWhitePaper72209.pdf

Marianne Horinko, White Paper, "Carbon Capture and Sequestration Legal and Environmental Challenges Ahead," August 2007
http://www.publicpower.org/files/PDFs/Horinko%20CCS%20White%20Paper%20August%2007.pdf

Jonathan Gledhill, Policy Navigation Group; James Rollins, Policy Navigation Group; Theresa Pugh, APPA, White Paper, "Will Water Issues/Regulatory Capacity Allow or Prevent Geologic Sequestration for New Power Plants? A Review of the Underground Injection Control Program and Carbon Capture and Storage," November 2007
http://www.publicpower.org/files/PDFs/UICCCSpaper.pdf

Theresa Pugh Presentation, "Sober Thoughts About CCS for Retrofit or New Fossil Plants as a CO_2 Mitigation Measure from 2009-2029," Presented Nov. 3, 2009
http://www.publicpower.org/files/PDFs/PughCCSpresentation110309.pdf

Theresa Pugh Presentation, "Infrastructure Costs, Permitting Issues and Parasitic Energy Loss for Power Plants with CCS," Presented Jan 29, 2008 in Tucson, AZ
http://www.publicpower.org/files/PowerPoint/TPEUECPresentation2008.ppt

Carbon Capture and Storage: Analysis of Potential Liabilities Associated with Groundwater Contamination Due to Geological Sequestration Operations, September 10, 2008
Prepared by Fredric P. Andes and Kari A. Evans, members of the Barnes & Thornburg LLP Water Team, for the American Public Power Association (APPA)
http://www.publicpower.org/files/PDFs/APPA%20CCS%20white%20paper%20Waters%20of%20the%20US.pdf

CITY UTILITIES

Bringing Power Home.

Scott Miller

Scott Miller is General Manager and Chief Executive Officer for City Utilities of Springfield, Missouri. He assumed his current responsibilities in June 2011. Scott joined City Utilities in 2002 as the Associate General Manager for Electric Supply. Prior to his career at City Utilities, Scott served as Director of Steam Generation for The Dayton Power and Light Company in Dayton, Ohio.

Scott earned a Bachelor of Science degree in Mechanical Engineering from the University of Texas at Austin, a Master's degree in Business Administration from Wright State University, and holds a Professional Engineers License. He has 27 years of experience in the utility industry.

Scott serves on the Boards of Directors of the American Public Power Association in Washington, DC, The Energy Authority in Jacksonville, Florida, and the Missouri Joint Municipal Electric Utility Commission. He is also active in a number of community organizations, including Springfield Business Development Corporation, Springfield Innovation, Inc., and the Partnership for Sustainability.

City Utilities of Springfield, MO provides electricity, natural gas, water, transit, and telecommunications/broadband services to 250,000 citizens in the city and surrounding area.

The New York Times | http://nyti.ms/1i1vFJW

ENERGY & ENVIRONMENT

Coal to the Rescue, but Maybe Not Next Winter

By MATTHEW L. WALD MARCH 10, 2014

COLUMBUS, Ohio — When the temperature here dropped into the teens this winter, ice formed on the inside of Ernestine J. Cundiff's windows in the drafty 50-year-old apartment building where she lives. At 81, with diabetes, poor circulation in her legs and both shoulders damaged in separate falls last year, Ms. Cundiff said wearing leggings and fur-lined slippers was not enough to keep her warm, so she took to using an electric space heater in her bedroom.

Then came the electric bill, $96.75 in January, up about 50 percent from the previous month. That was in addition to a gas bill of $153.44, up from $106.12 the month before. "When I opened the bills, I thought I was going to have another heart attack," said Ms. Cundiff, whose only income is the $1,226 a month she receives from Social Security.

Like many other people this winter, Ms. Cundiff turned to a community service organization. Impact Community Action, a Columbus agency, enrolled her in a state program that holds energy bills to 6 percent of a person's income. Regina Clemons, the director of emergency assistance at Impact, said the group was on track to sign up 9,000 to 10,000 people this winter, compared with about 8,000 last winter.

"We find people who have never ever walked into a community action agency before, looking for help," said Carmen Allen, the community outreach coordinator.

As the end of the harshest winter in recent memory approaches, the bill is

coming due for millions of consumers who are not only using more electricity and natural gas but also paying more for whatever they use. And there might not be relief in future winters, as the coal-fired power plants that utilities have relied on to meet the surge in demand are shuttered for environmental reasons.

The sticker shock has been particularly acute in the Northeast, where natural gas supplies have been constrained. But it has spread to other regions of the country, including the Midwest, where utilities have had to draw on more expensive reserves to meet the demand.

In Pennsylvania, Attorney General Kathleen G. Kane said her office had been flooded with complaints from consumers whose utility bills had soared, in some cases tripling. In Rhode Island, the utility National Grid received permission for a 12.1 percent electricity rate increase in January, nearly all of it because of higher prices for the gas used to make electricity.

In New York, Con Edison increased the price of each kilowatt-hour about 16 percent this month compared to last year. And in Ohio, energy retailers will demand higher prices from customers like Ms. Cundiff when annual contracts are renewed.

Underlying the growing concern among consumers and regulators is a second phenomenon that could lead to even bigger price increases: Scores of old coal-fired power plants in the Midwest will close in the next year or so because of federal pollution rules intended to cut emissions of mercury, chlorine and other toxic pollutants. Still others could close because of a separate rule to prevent the damage that cooling water systems inflict on marine life.

For utilities, another frigid winter like this one could lead to a squeeze in supply, making it harder — and much more expensive — to supply power to consumers during periods of peak demand.

Senator Lisa Murkowski of Alaska, the ranking Republican on the Senate Energy Committee, told utility regulators in a speech on Feb. 11 that the recent frigid weather had provided "a glimpse of the challenge that lies ahead." American Electric Power, which serves Columbus and a vast area of the Midwest, was running 89 percent of the coal plants that it must retire next

year, she said.

"That raises a very serious question," she said. "What happens when that capacity is gone?"

The coal plants are dirty, and expensive compared to natural gas at summertime prices. But coal is far less prone to price jumps or to shortages, and in a cold snap, it looks like a bargain. Without the coal plants, experts agree, prices in the peak periods of winter and summer will be higher, so future periods of cold weather may be even harder on electric bills.

"We are seeing unprecedented amounts of coal units retiring," said Andrew L. Ott, a senior vice president at PJM Interconnection, the grid operator that covers Pennsylvania, New Jersey and Maryland and has expanded into West Virginia, Ohio and adjacent areas.

"No doubt this industry is in a massive transition," he said, adding that the change would be accompanied by more price volatility.

PJM recently set a peak record for winter energy use of about 140,000 megawatts. Its summer record is 168,000 megawatts. Plants that use coal, with a combined capacity of about 12,000 megawatts, are retiring. Enough capacity is available, and new gas-fired units are being built, but while gas production has kept up with consumption, pipeline capacity has not.

In some cases, the Environmental Protection Agency has reduced the disruption caused by retirements by delaying deadlines, to give utilities more time to comply with its rules or to get alternate arrangements in place. But American Electric Power executives say that will not be the case this time, because even with a reprieve from Washington, citizens could bring lawsuits under the Clean Air Act that would force the closures.

What's more, many plants are far along the path to retirement. At Muskingum River, a five-boiler coal plant in Beverly, Ohio, about 100 miles southeast of Columbus, three of the units ran during the so-called polar vortex, supplying power to meet the demand.

But three-quarters of the 400 or so employees the plant had two years ago are gone, and two of the five units need half-million-dollar repairs to run again, an expensive proposition for a plant that is scheduled to close and runs only intermittently.

American Electric Power has stopped hiring at other plants that are scheduled to remain in service, to make space for employees who would like to transfer. Units 1 and 2 at Muskingum River, commissioned in the early 1950s, cannot run anymore because they both need a new lining in the floor of their boilers, at a cost of about $500,000 each, and there would be no time to recoup the investment. Unit 5, the youngest, commissioned in 1968, was a candidate for continued use, but it would need upgrades to reduce pollution that would cost hundreds of millions of dollars. Lately the plant has run only on very hot or very cold days.

The plants set to be closed will not be replaced by newer, cleaner coal plants, and a number of new gas plants are planned or under construction. The average price of natural gas is too low to let coal compete, and new rules loom for carbon dioxide emissions from new coal plants. And it is not only coal that is disappearing from the mix. Nuclear energy is, as well. Last year the energy company Dominion closed its Kewaunee reactor in Wisconsin, which had been running smoothly and without opposition but could not produce power at a competitive rate in the Midwest electricity market. Another energy supplier, Entergy, announced that it would close Vermont Yankee, a nuclear power station in Vernon, Vt., because the cost of production was higher than the market rate for power. In both cases, the main challenge was natural gas, which has remained cheap apart from the recent price surges.

Marvin Fertel, the president of the Nuclear Energy Institute, the industry's trade association, told Wall Street analysts on Feb. 13 that the gas crunch illustrated the need for diverse sources of energy.

"Risks are lower with diverse portfolios," he said, but the competitive market does not reward diversity. Nor does it reward a coal plant with a supply of fuel that could last weeks in a pile nearby, or a reactor with 18 to 24 months of fuel in its core, he said.

At the Muskingum River coal plant, there was resignation and uncertainty. Muskingum will be "dispositioned," in the new jargon, while other plants, with more antipollution equipment, have been designated "keepers." The plant opened six years before Craig Douglass, 54, was born, and Mr. Douglass, an outage coordinator who has worked there for 33 years,

said of the people who built it, "I don't think they ever imagined they'd be running that long."

Mr. Douglass is going to a "keeper" plant. Others are retiring. In the control room one recent afternoon, there was an odd mix of crisp, modern computer screens and control panels that looked as if they had been borrowed from a 1950s science fiction film. Michael Stehly, 55, a supervisor, clearly did not want to operate either.

"I might be the guard at the gate," he said, "who lets the scrap metal trucks in and out."

A version of this article appears in print on March 11, 2014, on page B1 of the New York edition with the headline: Coal to the Rescue, This Time.

American Water Works Association
Dedicated to the World's Most Important Resource™

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March 12, 2014

The Honorable Lamar Smith, Chair

The Honorable Eddie Bernice Johnson, Ranking Member

House Committee on Science, Space, and Technology

Dear Mr. Smith and Ms. Johnson,

The American Water Works Association requests that this letter and attachment be entered into the record of the Committee's hearing today on carbon capture and storage (CCS). While the American Water Works Association has not taken a position at this time on whether EPA should eventually encourage or even mandate CCS as a method for controlling greenhouse gas emissions, we believe very strongly that underground sources of drinking water (USDW) must be protected from CCS activities. CCS has not been implemented anywhere for large volumes of CO_2 injection. Therefore, it should be considered an experimental technology and could pose significant risks to drinking water sources if rushed prematurely to commercial scale.

Although EPA's Class VI rules promulgated under the Safe Drinking Water Act's Underground Injection Control program address many of the potential causes of drinking water contamination, AWWA continues to be concerned with some of the rule's provisions that were included over the strong objections of the drinking water community. For example, the "injection depth waiver" process allowed by the Class VI rule has many limitations that could result in degradation of USDW.

Essentially, the drinking water community and the citizens it serves are being asked to "trust" that geologic sequestration technology will work as promised, even though there is very little if any experience with this technology at a large scale. Although several DOE-sponsored projects have been successful, these projects have been too small and few in number to provide confidence that carbon sequestration projects will be protective of USDW at large injection volumes. Moreover, it is likely that many areas are simply unsuitable for CCS based on geology or other factors.

We are concerned that the risk of unintended consequences from geologic sequestration is high, and such consequences could be difficult or impossible to correct after contamination of USDW. It is quite possible that CCS could make large amounts of USDW permanently unsuitable for use as community water supply.

These points are not to suggest that CCS cannot or should not go forward. But we believe the technology has not been proven and is, in fact, not well understood at the scale anticipated. Nor, we must add, is

EPA's regulatory system for CCS robust and mature since, to the best of our knowledge, not a single Class VI UIC permit has been issued.

AWWA remains committed to working with the EPA, DOE, and interested groups to address the impacts and causes of climate change. However, we strongly believe that it makes no sense to protect our air at the expense of our water. We need both clean air and clean water. Therefore, we ask that you ensure the promised benefits of CCS are carefully weighed against its potential costs and the risks of unintended consequences before the nation makes an irrevocable commitment to CCS.

We would be happy to meet with you at any time or answer any questions you may have concerning our views and concerns on this important issue.

Respectfully,

Thomas W. Curtis
Deputy Executive Director
American Water Works Association

E. SCOTT PRUITT
ATTORNEY GENERAL OF OKLAHOMA

February 28, 2014

VIA CERTIFIED MAIL & E-MAIL

The Hon. Regina A. McCarthy
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Re: Draft Underground Injection Control (UIC) Program Guidance on Transitioning Class II Wells to Class VI Wells

Comments from the Attorneys General of the States of Oklahoma, Alabama, Michigan, Nebraska, South Carolina, Texas and Wyoming

Dear Administrator McCarthy:

We are writing to express our concern over the Environmental Protection Agency's (EPA) Draft Underground Injection Control (UIC) Program Guidance on Transitioning Class II Wells to Class VI Wells (Draft Guidance), issued in December 2013. The Draft Guidance proceeds from an inaccurate understanding of the authority of a Class VI regulator with respect to Class II wells and therefore unlawfully interferes with the authority granted to States under the UIC Program. We respectfully request that EPA resolve this fundamental flaw to protect vital sectors of our economy and preserve the well-being of the citizens and businesses of our States.

The Safe Drinking Water Act's (SDWA) UIC Program is intended to protect subsurface supplies of drinking water from the drilling and use of underground wells for various industrial activities. Under this program, oil and gas wells are classified as "Class II" wells, and, pursuant to the structure of the UIC Program and primacy agreements with EPA, our states – and not EPA

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– serve as the primary regulators of Class II wells. Recently, EPA created a new class of wells under the UIC Program, known as "Class VI" wells, for the underground injection and storage of carbon dioxide (CO_2), primarily in connection with prospective carbon capture and storage (CCS) operations. *See* 75 Fed. Reg. 77230 *et seq.* (Dec. 1, 2010). *See also* 75 Fed. Reg. 75060 (Dec. 1, 2010).

Notwithstanding this new class of wells intended to accommodate the underground injection of CO_2, many oil and gas producers operating Class II wells have been injecting CO_2 for the past 40 years to manipulate well pressure and enhance the recovery of oil and gas. This process, commonly referred to as enhanced oil recovery (EOR), has been used in more than 10,000 wells, about 7,000 of which are currently active. EOR represents a critically important part of our states' and our country's energy infrastructure and plays an essential role in our nation's economic stability and energy security.

The Draft Guidance, arising from EPA's newly-created Class VI wells, is directed at the interplay between Class II and Class VI wells as it relates to underground CO_2 injection. But rather than provide clarity and avoid interfering with the production of oil and gas via EOR – which, again, we emphasize has been occurring for the past several decades without increased risk to drinking water and other subsurface assets – the Draft Guidance has introduced confusion and uncertainty into the oil and gas industry and failed to resolve the business community's outstanding issues with the UIC Program.

Specifically, the Draft Guidance indicates that a regulator in an EPA regional office overseeing Class VI wells (*i.e.*, the Class VI Director) has the authority to determine whether a Class II well at which EOR operations are occurring must "transition" to a Class VI well. This flies in the face of prevailing industry practice, as well as common sense. It also violates current law and the proper division of authority between EPA and states under SDWA.

As part of its rulemaking in 2010 creating the Class VI well category, EPA articulated a series of factors by which a Class II well with EOR operations could be reclassified a Class VI well, presumably to perform CCS-type operations instead. 40 C.F.R. § 144.19. This included such criteria as an increase in reservoir pressure within the injection zone, an increase in CO_2 injection rates, suitability of the Class II area of review delineation, the owner's or operator's plan for recovery of CO_2 at the cessation of injection, the source and properties of injected CO_2, and any additional site specific factors as determined by the regulator. *Id.* Many Class II permit holders communicated to EPA that these criteria were too vague and could lead to the reclassification of wells in which CCS was neither intended nor actually occurring. In response, EPA prepared and issued the Draft Guidance in December 2013.

The Draft Guidance correctly states that while CO_2 is stored underground during EOR operations in a Class II well, this alone does not require the transition of the Class II well into a Class VI well. To the contrary, EPA has plainly stated that EOR operations at a Class II well are not to be affected by the Class VI rule:

> Traditional ER projects are not impacted by this rulemaking and will continue operating under Class II permitting requirements. EPA recognizes that there may be some CO_2 trapped in the subsurface at these operations; however, if there is no increased risk to [underground sources of drinking water (USDW)], then these operations would continue to be permitted under Class II.

75 Fed. Reg., at 77245. The Draft Guidance properly reiterates this point, stating "[t]raditional EOR projects are not affected by the Class VI rulemaking and will continue to be permitted under Class II requirements." Draft Guidance, at 1.

But then the Draft Guidance goes on to describe scenarios in which a Class II well with EOR operations would need to be reclassified as a Class VI well, based on the unchecked increase in subsurface pressures caused by the injection of CO_2. This is blatantly inconsistent with prevailing practices in the oil and gas industry and contrary to law.

Under the UIC Program, our states are vested with authority to permit Class II wells with EOR for purposes of enabling the production of oil. As part of this, the state-level Class II Director reviews maximum and average injection pressures and other information to ensure that CO_2 injection will "not result in the movement of fluids into a USDW so as to create a significant health risk." Draft Guidace, at A-4-A-5. Class II regulations specify limits on injection pressures to prevent the movement of injection or formation fluids into a USDW or the fracturing of the confining zone. *Id.* at A-8. *See also* 40 C.F.R. § 146.23(a). The Class II framework is thus wholly competent to prevent unchecked increases in subsurface pressures during EOR operations and other traditional oil and gas production methods. The scenario described by EPA as a trigger for reclassification simply is not reflective of real world operating conditions.

The actual circumstance under which reclassification would occur, also described in the Draft Guidance, is where a Class II operator changes the primary purpose of the well from the production of oil to the maximal underground storage of CO_2 and, in so doing, changes its operations in such a way as to transcend the confines of the Class II regulatory structure and create an "increased risk to USDWs compared to traditional Class II operations using carbon dioxide." Draft Guidance, at ii. Importantly, this is not so easily done. A Class II permit holder cannot change from EOR to maximal CO_2 storage without accounting for numerous other interests and legal and business considerations. For example, its contractual obligations with land owners and/or subsurface rights holders would most likely need to be altered, if not renegotiated, to accommodate such a transition. Similarly, state laws intended to enable oil and gas production can, in certain circumstances, interfere or even prohibit the use of oil and gas wells for maximal CO_2 storage if future production would be inhibited.

But regardless, the Draft Guidance further complicates and confuses the situation by erroneously implying that the Class VI Director can, on his or her own volition, preempt the Class II Director and require the Class II permit holder to file for reclassification under ClassVI. This is not lawful. Allowing the Class VI Director to "second guess" the Class II Director and intervene seemingly on a whim violates EPA's own rules regarding state primacy and flagrantly impinges upon state authority. EPA cannot revoke a state's primacy unless it can show a failure to comply with applicable requirements. 40 C.F.R. § 145.34(b). These requirements prescribe a series of detailed steps EPA must follow in order to do so, including providing adequate notice to the state and allowing the state sufficient time to take corrective action.

Thus the Draft Guidance, in overtly implying that the Class VI Director is empowered to act unilaterally within an industry in which he or she lacks requisite experience – thereby exposing a Class II permit holder to the seemingly unbounded risk of being ordered, absent any

specific criteria, to apply for reclassification – is utterly and entirely beyond the bounds of EPA authority and carries the very real possibility of doing harm to our nation's energy infrastructure. Moving beyond the confines of a traditional Class II well with EOR operations to maximal CO_2 storage is not easily nor quickly done and implicates significant economic and other business considerations. Allowing the Class VI Regulator to intervene seemingly without basis adds an unconscionable level of uncertainty and risk to a mature area of industrial activity already well and thoroughly regulated.

For the foregoing reasons, we respectfully request you take immediate action to rectify this situation as the Draft Guidance is finalized and, additionally, through any other rulemakings as may be necessary under the UIC Program to eliminate this uncertainty and ensure strict adherence to applicable law.

Sincerely,

E. Scott Pruitt
Oklahoma Attorney General

Luther Strange
Alabama Attorney General

Greg Abbott
Texas Attorney General

Bill Schuette
Michigan Attorney General

Peter Michael
Wyoming Attorney General

Jon Bruning
Nebraska Attorney General

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Daily News

Sierra Club Opposes CCS Coal Utility EPA Cites In Climate NSPS Defense

Posted: March 10, 2014

The Sierra Club is opposing a pending coal-fired power plant in Mississippi that will be among the first to use carbon capture and sequestration (CCS) on a large scale, even though the group backs EPA's proposed utility climate rule that justifies a CCS mandate for new coal plants based in part on the Mississippi plant -- a position critics say is "tortured."

In response, a source with the Sierra Club headquarters says the group's opposition to Southern Company's almost-complete Kemper coal utility in Mississippi "is independent of the CCS question. . . . We support CCS as a requirement for construction of new coal-fired power plants. . . . When we talk about whether we support a plant, we look at the individual situation," the source says, noting that few coal plants escape opposition from environmental groups.

But one industry source says, "An organization that is opposed to all coal plants may not really be in favor of carbon capture. . . . Of course the Sierra Club has a tortured position. They're against coal."

The group's backing of CCS as a mandate for newly constructed coal plants in EPA's pending carbon dioxide (CO2) new source performance standard (NSPS) would "presume they would advocate the use of fossil fuels, and Sierra Club doesn't. I assume at some point their donor base points that out to them," the source says.

A source with environmental group Clean Air Task Force (CATF) also questions Sierra Club's battle against the Kemper facility, saying that the opposition appears to focus more on the capital costs and its impact on electricity rates, rather than more typical concerns about the plant's environmental impacts.

The fight over the Kemper plant highlights several ongoing key issues in the debate over regulating the utility sector's CO2 emissions: the scope of the industry's emissions, the need to promote power sector projects to deploy CCS technology, and hurdles to completing construction of utilities with CCS.

The fate of CCS projects at utilities is central to EPA's pending NSPS for future power plants, which would require partial CCS at new coal-fired plants. Critics of the proposed rule say this represents a "war on coal" that would effectively ban new coal utility construction because CCS is cost-prohibitive and not in wide use.

EPA has defended the CCS mandate, which is based in part on Kemper and a handful of other pending coal utility CCS projects as showing it is viable for new sources. The rule cites other CCS projects, including Summit Power's Texas Clean Energy Project -- though that may be in doubt after its power purchase agreement expired in January.

CCS Project

Southern Company, which is developing the 582-megawatt Kemper County Energy Facility that will capture 65 percent of its CO2, has urged EPA not to rely on the plant to support its proposed CCS mandate. The project has received significant funding from the Department of Energy (DOE), and opponents of the NSPS claim a 2005 energy law prohibits EPA from citing DOE-funded projects to justify CCS regulatory mandates, though EPA in a recent data notice rejected that claim.

The agency first proposed the climate NSPS in 2012 but in response to comments withdrew it and re-proposed it in January. During the lag time, EPA increased its reliance on Kemper, noting in the new proposal that since April 2012 the project has made "significant progress" and is now "over 75 percent complete."

Sierra Club backs EPA's NSPS and its CCS mandate, even as it pursues a challenge to the Kemper facility, prompting criticisms from other environmentalists and industry sources for a "tortured" position.

Sierra Club's Mississippi chapter has been working since 2009 to defeat Kemper, citing its capital costs of more than $5 billion, the impact on ratepayers, and concerns about non-GHG emissions from the plant.

But the source with the CATF -- a vocal supporter of both CCS and Kemper -- says Sierra Club appears to be opposing the project for the wrong reasons, such as costs rather than environmental impacts. The source "is prepared to concede that this is an expensive plant," because with $5 billion in costs and overruns it is the most expensive capital project ever undertaken in the state of Mississippi. However, the source believes the project is vital to advancing CCS, "a technology that is essential to avoiding the worst aspects of climate change."

Many of Sierra Club's attacks on Kemper "focus exclusively on costs and not on the environment. . . . Last I checked that wasn't the central focus of the Sierra Club's mission: saving ratepayer money in Mississippi," the source says.

The industry source concurs with that response, saying, "This is the only time in the history of the planet that Sierra Club has demonstrated any concern with what the ratepayers need to pay. To say it is a smokescreen is way too kind. They have never complained about the rate impact of a wind farm."

However, the Congressional Research Service in a Feb. 10 report on DOE-funded CCS projects notes, "Cost overruns at the Kemper plant, however, have raised questions over the relative value of environmental benefits due to CCS technology compared to construction costs of the facility and its effect on ratepayers."

Sources also point out that Sierra Club's position is somewhat the inverse to Kemper's developer, Southern Company, which in public statements last fall urged EPA not to cite it as a basis for the NSPS rule. For example, Southern Company's gasification manager, Randall Rush, called Kemper a "specific project in a specific place that meets the needs of the state of Mississippi. . . . It doesn't seem to make any sense to me to be a basis for an environmental standard on a national basis."

EPA Proposal

In order to mandate CCS in the NSPS rule being developed under section 111(b) of the Clean Air Act, EPA must show that the technology is commercially available and adequately demonstrated. It also must show that it is not relying solely on Kemper and the other CCS projects it cites in the proposal because they are receiving DOE funding.

In the proposal, EPA cites Kemper as one of the main examples, and lauds its progress, saying, "Performance testing is expected to commence in late 2013 and the facility is expected to be fully operational in 2014."

The Kemper County energy facility will use Southern Company's Transport Integrated Gasification (TRIG) technology, developed with significant DOE funding that will allow it to gasify lower grade lignite coal and then capture the carbon and pipe it to nearby oil fields. GHG and criteria emissions from the plant will be comparable to a natural gas facility.

A second industry source -- who says EPA should not rely on Kemper and other DOE-funded projects to justify he NSPS -- says these projects "fall short of what EPA needs to show for CCS to be adequately demonstrated," but they are nonetheless important for the further development of CCS technologies. "CCS needs more public-private partnerships focused on advancing the technology and more support and incentives for new projects. CCS just isn't ready to respond to a regulatory mandate from EPA, and the mandate alone won't make it ready."

Southern Company in a Feb. 26 statement to *Inside EPA* said, "The proposed standards for new coal-fired power plants appear to be based on CCS and the anticipated performance of the Kemper County energy facility." But the company added that, "Because the unique characteristics that make the project the right choice for Mississippi cannot be consistently replicated on a national level, the Kemper county energy facility should not serve as a primary basis for new emissions standards impacting all new coal-fired power plants."

The CATF source says the company's and Sierra Club's positions on Kemper and the NSPS "are useful in the broader debate" over the viability of CCS. "Southern is saying we built this plant, and it's great, but it doesn't provide that CCS is viable" in the EPA rule. "Then Sierra Club opposes the plant because they think it's horrible but they think the rule is great. . . . We think it should be built and we think including CCS in the NSPS is viable."

But the Sierra Club headquarters source disagrees, saying, "We evaluate power plant proposals on a plant-by-plant basis in conjunction with local chapters. And a decision was made that we did not support the Kemper proposal. We are not opposing it because it's CCS and we obviously are willing to oppose plants that include CCS as a technology."

The group also believes Kemper serves as proof that it is "reasonable for EPA to conclude it is technologically possible to" include CCS in the NSPS, the source says. But is it also "important to point out that Kemper is not a normal CCS plant. They are trying to prove their own gasification technology," for one.

Further, the group points out, the plant has no regulatory requirement to actually capture any of its carbon emissions if the CCS does not work or other problems occur, as consulting firm Element VI noted in an analysis last year.

Environmentalists' Concerns

A source with Sierra Club's Mississippi chapter details several environmental problems with the plant, including that the particulate matter and mercury controls are not as stringent as they could be, and that it includes a 45-square-mile lignite strip mine. Further, the facility's certificate of need is again before the state supreme court; the state has issued questionable bonds to help finance the project; and residents' taxes have increased, the source says.

"This has definitely been clouded with what I would consider to be a lot of eyebrow-raising events," the source says, the upshot of which shows that Kemper is "dirty, it's expensive and it's unnecessary." The source alleges Kemper is not about CCS but rather a way for the company to win DOE financing for its TRIG technology. Because Mississippi is a regulated state, "For every dollar they spend, they get to collect a 10 to 12 percent rate of return by law."

The $5.25 billion in costs for the project will be most keenly felt by its 189,000 customers in one of the poorest states in the country, many of whom live on fixed incomes, the source adds.

But the second industry source stresses the importance of Kemper as "the world's only coal plant of any meaningful size with CCS that's currently under construction," the source says. "Coal use is growing around the world, particularly in Asia, and it's quite possible that if you don't have projects like Kemper today, then all this overseas coal gets built in the years ahead without CCS and, as a result, without any constraint on their CO2 emissions."

This source faults Sierra Club's Kemper opposition as "very clear in terms of what they don't like but not clear in terms of what they do. You might think you can just get rid of coal, but a quick look around the world shows coal use going up, no matter what happens in the United States. This is why other environmental groups have recognized CCS as a vital part of any effort to address climate change. Sierra Club is basically on its own." -- *Dawn Reeves (* dreeves@iwpnews.com *)*

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ISSUE BRIEF

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EPA's Climate Regulations Will Harm American Manufacturing

Nicolas Loris and Filip Jolevski

The Environmental Protection Agency's (EPA) forthcoming climate change regulations for new and existing electricity generating units have been appropriately labeled the "war on coal,"[1] because the proposed limits for carbon dioxide emissions would essentially prohibit the construction of new coal-fired power plants and force existing ones into early retirement.

However, the casualties will extend well beyond the coal industry, hurting families and businesses and taking a significant toll on American manufacturing across the nation. Congress should stop the EPA and all other federal agencies from regulating carbon dioxide and other greenhouse gas emissions.

Driving Energy Prices Up, Economic Activity Down. Coal provides approximately 40 percent of America's electricity generation.[2] By significantly limiting the use of an affordable energy source, the EPA's regulations will increase electricity prices for American households. Since low-income families spend a larger proportion of their income on energy, a tax that increases energy prices would disproportionately affect the budgets of the poorest American families.

This paper, in its entirety, can be found at
http://report.heritage.org/ib4158

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Higher energy prices as a result of the regulations will squeeze both production and consumption. Since energy is a critical input for most goods and services, Americans will be hit repeatedly with higher prices as businesses pass higher costs onto consumers. However, if a company had to absorb the costs, high energy costs would shrink profit margins and prevent businesses from investing and expanding. The cutbacks result in less output, fewer new jobs, and less income.

Heritage Foundation analysts modeled the economic effects of a phase-out of coal between the years 2015 and 2038. Using the Heritage Foundation Energy Model, a derivative of the federal government's National Energy Model System, we found that by the end of 2023, nearly 600,000 jobs will be lost, a family of four's income will drop by $1,200 per year, and aggregate gross domestic product decreases by $2.23 trillion over the entire period of the analysis.[3]

Manufacturing Hit Hard. America's manufacturing base will be particularly harmed by the EPA's climate regulations. Manufacturing accounts for over 330,000 of the jobs lost.[4] This occurs for a number of reasons.

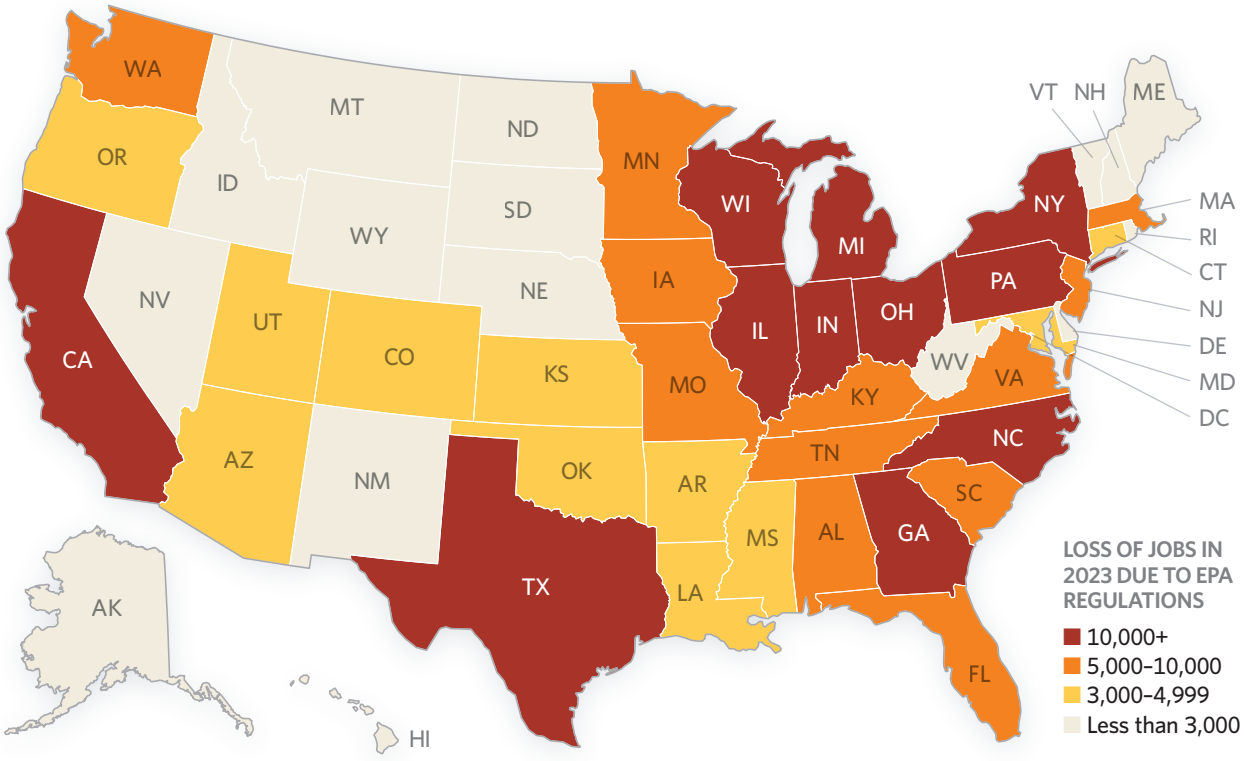
As more coal generation is taken offline, the marketplace must find a way to make up for that lost supply. The Heritage Energy Model builds in the most cost-effective means of replacing the lost coal through a combination of consumers decreasing energy use as an adjustment to higher prices and increased power generation from other sources.

Manufacturing is an energy-intensive industry, and the impact of the higher energy prices on manufacturing averages to more than 770 jobs losses per congressional district. However, not all regions are

MAP 1

The Cost of EPA Regulations: 336,000 Manufacturing Jobs in One Year

In just one year (2023), Environmental Protection Agency regulations on electric plants would eliminate 336,000 manufacturing jobs around the U.S. The map below shows the breakdown by state.



California	-37,439	Massachusetts	-6,920	Nebraska	-2,277
Texas	-24,504	Virginia	-6,592	New Hampshire	-1,978
Ohio	-18,191	South Carolina	-6,149	Idaho	-1,545
Illinois	-17,115	Alabama	-6,143	West Virginia	-1,414
Pennsylvania	-16,576	Kentucky	-5,626	Maine	-1,359
Michigan	-16,215	Iowa	-5,140	Rhode Island	-1,295
New York	-13,868	Arizona	-4,564	Nevada	-1,150
Indiana	-12,520	Oregon	-4,379	New Mexico	-990
North Carolina	-12,032	Connecticut	-4,339	South Dakota	-929
Wisconsin	-11,702	Colorado	-4,078	Delaware	-920
Georgia	-10,360	Kansas	-3,938	Vermont	-789
Florida	-9,921	Arkansas	-3,912	North Dakota	-594
New Jersey	-8,497	Oklahoma	-3,723	Montana	-481
Minnesota	-8,465	Louisiana	-3,605	Hawaii	-443
Tennessee	-8,114	Mississippi	-3,477	Alaska	-300
Washington	-7,492	Maryland	-3,377	Wyoming	-280
Missouri	-7,164	Utah	-3,111	District of Columbia	-84

Source: Calculations based on data from the Heritage Foundation Energy Model and employment data from the U.S. Census Bureau, American Community Survey.

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affected the same, as districts in Wisconsin, Ohio, Indiana, Michigan, and Illinois are especially hit hard. In fact, 19 out of the top 20 worse off congressional districts from the Administration's war on coal are located in the Midwest region. In those districts, the manufacturing industry, on average, will slash more than 1,600 jobs by 2023. The table at the end of the paper shows the estimates of the decrease of manufacturing employment per congressional district by 2023.

Furthermore, manufacturing growth will be harmed as a result of the fuel switching that will occur to make up for lost coal generation. Natural gas will be diverted away from manufacturing and to power generation. As a result, the Heritage Energy model projects that natural gas prices will increase 28 percent by 2030.

Natural gas and liquids produced with natural gas provide a feedstock for fertilizers, chemicals and pharmaceuticals, waste treatment, food processing, fuel for industrial boilers, transportation fuel, and much more. The chemical-manufacturing base alone is building 148 new operations topping over $100 billion in response to current and projected low natural gas prices from the shale gas boom.[5] As the U.S. is experiencing a renaissance in manufacturing and energy-intensive industries, the Administration's war on coal could adversely affect America's competitive advantage.

Availability of Carbon Capture and Sequestration. The primary reason the EPA's regulations will ban the construction of coal-fired electricity generating units is that to meet the thresholds,

TABLE 1

Six Midwest States Hit Hardest by EPA Regulations

MANUFACTURING JOB LOSSES IN 2023, AS AN AVERAGE FOR CONGRESSIONAL DISTRICTS

Wisconsin	-1,463	Nebraska	-759
Indiana	-1,391	Washington	-749
Iowa	-1,285	Oklahoma	-745
Michigan	-1,158	Georgia	-740
Ohio	-1,137	New Jersey	-708
Minnesota	-1,058	California	-706
New Hampshire	-989	Texas	-681
Kansas	-985	Maine	-680
Arkansas	-978	Rhode Island	-648
Illinois	-951	Louisiana	-601
Kentucky	-938	Virginia	-599
South Dakota	-929	North Dakota	-594
North Carolina	-926	Colorado	-583
Pennsylvania	-921	New York	-514
Delaware	-920	Arizona	-507
Tennessee	-902	Montana	-481
Missouri	-896	West Virginia	-471
South Carolina	-878	Maryland	-422
Alabama	-878	Florida	-367
Oregon	-876	New Mexico	-330
Mississippi	-869	Alaska	-300
Connecticut	-868	Nevada	-288
Vermont	-789	Wyoming	-280
Utah	-778	Hawaii	-222
Idaho	-773	D.C.	-84
Massachusetts	-769		

Source: Calculations based on data from the Heritage Foundation Energy Model and employment data from the U.S. Census Bureau, American Community Survey.

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1. Zack Coleman, "White House adviser: 'War on coal is exactly what's needed'" *The Hill*, June 25, 2013, http://thehill.com/blogs/e2-wire/e2-wire/307571-white-house-adviser-war-on-coal-is-exactly-whats-needed (accessed February 28, 2014).
2. U.S. Energy Information Agency, "Short Term Outlook—February 2014," Table 7d, http://www.eia.gov/forecasts/steo/tables/pdf/7dtab.pdf (accessed February 26, 2014).
3. See Nicolas D. Loris, Kevin D. Dayaratna, and David W. Kreutzer, "EPA Power Plant Regulations: A Backdoor Energy Tax," Heritage Foundation *Backgrounder* No 2683, December 5, 2013, http://www.heritage.org/research/reports/2013/12/epa-power-plant-regulations-a-backdoor-energy-tax (accessed February 26, 2014).
4. Out of a total of 670,000 jobs lost. This differs from the estimates referred to earlier (600,000 jobs lost), which are calculated from the Heritage Foundation Energy Model using employment figures from the Current Population Survey. These new estimates are calculated from the same Heritage Foundation Energy Model but use employment data from the American Community Survey in order to illustrate the impact in various congressional districts. Other coal dependent states that are not heavy manufacturers will also be significantly impacted by the EPA's regulations. For instance, although West Virginia and Wyoming are relatively low on manufacturing jobs lost, Heritage estimates these will be the two hardest hit states in terms of overall job losses per 100,000 employed. For a more detailed explanation of the overall job losses and methodology, see ibid.
5. *Business Standard*, "U.S. Chemical Industry Invest $100 Bn Due to Shale Gas Boom," February 22, 2014, http://www.business-standard.com/content/b2b-chemicals/us-chemical-industry-invest-100-bn-due-to-shale-gas-boom-114022400678_1.html (accessed February 26, 2014).

new plants will have to install carbon capture and sequestration (CCS) technology. As identified by the Obama Administration's Interagency Task Force on Carbon Capture and Storage 2010 report, implementation of CCS has a number of extremely difficult obstacles to overcome. There are questions of technical scalability, regulatory challenges, long-term liability of storing the captured carbon dioxide, and above all, cost.[6]

No credible basis exists to state that CCS is adequately demonstrated today, since no large-scale power plant in the U.S. has CCS. One large-scale CCS project is currently under contract—the Kemper County Integrated Gasification Combined Cycle (IGCC) plant—but it is hardly a model for new coal-fired plants for the rest of the country. Setting aside the fact that the project has had nearly half a billion dollars in cost overruns and received over $400 million in Department of Energy grants and preferential tax credits,[7] the plant is using a lower-grade lignite coal rather than higher-grade bituminous and subbituminous coal found in many parts of the rest of the country.

The Kemper plant will use IGCC technology that turns coal into gas as opposed to pulverized combustion and the captured carbon dioxide will serve a purpose for enhanced oil recovery to help finance the plant. New coal-fired plants in other parts of the country will not have those opportunities, so the Kemper plant is not an indicator of adequate demonstration. Further, the fact that the plant is not actually operating disqualifies it as the model. CCS should be pursued only if companies believe it is in their economic interest to do so—for instance, if profitable opportunities for enhanced oil recovery exist nearby.

Congress Stepping In. Senator Joe Manchin (D–WV) and Representative Ed Whitfield (R–KY) have introduced the Electricity Security and Affordability Act (H.R. 3826) that would require that greenhouse gas regulations for electricity generating units meet certain standards that prove they are economically feasible to achieve and have a demonstrated positive environmental benefit. Any imposed standards to limit or contain emissions cannot have been tested in isolation and with special treatment like the Kemper plant but must have been used commercially for a year by multiple plants (at least six) in multiple regions in order to be representative of the industry.

To truly ensure that the technology is cost-effective, Congress should strip away all subsidies and Department of Energy spending for CCS in order to prevent the federal government from presenting a handful of fundamentally uneconomic CCS plants as proof that the standards are legitimate. However, the most effective policy solution would be to prohibit the EPA and all agencies from regulating greenhouse gas emissions.

*—**Nicolas D. Loris** is Herbert and Joyce Morgan Fellow in the Thomas A. Roe Institute for Economic Policy Studies and **Filip Jolevski** is a Research Assistant in the Center for Data Analysis at The Heritage Foundation.*

6. Environmental Protection Agency, "Report of the Interagency Task Force on Carbon Capture and Storage," August 2010, http://www.epa.gov/climatechange/Downloads/ccs/CCS-Task-Force-Report-2010.pdf (accessed February 26, 2014).
7. Massachusetts Institute of Technology, "Kemper County IGCC Fact Sheet: Carbon Dioxide Capture and Storage Project," http://sequestration.mit.edu/tools/projects/kemper.html (accessed February 26, 2014).

TABLE 2

The Effects of EPA Regulations on Manufacturing Jobs, by Congressional District

The Environmental Protection Agency's regulations on electric power plants would cause the loss of hundreds of thousands of jobs around the U.S., most significantly in the manufacturing sector. The table below shows the number of manufacturing jobs lost, by state and congressional district, due to the regulations in just one year, 2023. ***The total for the U.S. would be 336,000 manufacturing jobs lost.***

ALABAMA	
1	-731
2	-813
3	-1,025
4	-1,175
5	-1,037
6	-669
7	-693
Total	-6,143
ALASKA	
At Large	-300
ARIZONA	
1	-382
2	-445
3	-409
4	-355
5	-783
6	-489
7	-557
8	-452
9	-692
Total	-4,564
ARKANSAS	
1	-967
2	-597
3	-1,201
4	-1,147
Total	-3,912
CALIFORNIA	
1	-356
2	-468
3	-466
4	-433
5	-733
6	-345
7	-427
8	-362
9	-537
10	-794
11	-470
12	-547
13	-531
14	-585
15	-986
16	-535
17	-1,819
18	-1,278
19	-1,275
20	-432
21	-372
22	-424
23	-410
24	-527
25	-826
26	-715
27	-625
28	-502
29	-758
30	-607
31	-639
32	-895
33	-751
34	-832
35	-960
36	-259
37	-469
38	-962
39	-985
40	-1,140
41	-683
42	-801
43	-781
44	-942
45	-1,008
46	-1,119
47	-863
48	-969
49	-698
50	-664
51	-454
52	-865
53	-555
Total	-37,439
COLORADO	
1	-516
2	-773
3	-364
4	-728
5	-476
6	-536
7	-685
Total	-4,078
CONNECTICUT	
1	-847
2	-1,017
3	-920
4	-580
5	-975
Total	-4,339
DELAWARE	
At Large	-920
DISTRICT OF COLUMBIA	-84
FLORIDA	
1	-335
2	-295
3	-331
4	-432
5	-397
6	-393
7	-412
8	-640
9	-305
10	-359
11	-292
12	-362
13	-571
14	-396
15	-438
16	-406
17	-248
18	-351
19	-218
20	-287
21	-302
22	-372
23	-393
24	-279
25	-506
26	-264
27	-337
Total	-9,921
GEORGIA	
1	-644
2	-623
3	-909
4	-589
5	-416
6	-605
7	-709
8	-633
9	-1,028
10	-730
11	-744
12	-753
13	-554
14	-1,423
Total	-10,360
HAWAII	
1	-256
2	-187
Total	-443
IDAHO	
1	-798
2	-747
Total	-1,545
ILLINOIS	
1	-495
2	-671
3	-901
4	-1,254
5	-811
6	-1,111
7	-530
8	-1,310
9	-660
10	-1,160
11	-1,009
12	-724
13	-715
14	-1,226
15	-1,057
16	-1,282
17	-1,228
18	-971
Total	-17,115
INDIANA	
1	-1,180
2	-1,874
3	-1,947
4	-1,402
5	-998
6	-1,524
7	-850
8	-1,486
9	-1,259
Total	-12,520
IOWA	
1	-1,537
2	-1,472
3	-782
4	-1,349
Total	-5,140
KANSAS	
1	-964
2	-834
3	-742
4	-1,398
Total	-3,938
KENTUCKY	
1	-1,083
2	-1,209
3	-814

TABLE 2

The Effects of EPA Regulations on Manufacturing Jobs, by Congressional District

4	-1,036
5	-546
6	-938
Total	-5,626

LOUISIANA

1	-582
2	-554
3	-659
4	-544
5	-472
6	-794
Total	-3,605

MAINE

1	-717
2	-642
Total	-1,359

MARYLAND

1	-670
2	-517
3	-450
4	-293
5	-302
6	-467
7	-349
8	-329
Total	-3,377

MASSACHUSETTS

1	-876
2	-964
3	-1,252
4	-790
5	-613
6	-820
7	-450
8	-566
9	-589
Total	-6,920

MICHIGAN

1	-714
2	-1,599
3	-1,324
4	-1,041
5	-863
6	-1,467
7	-1,244
8	-1,181
9	-1,293
10	-1,525
11	-1,430
12	-994
13	-799
14	-741
Total	-16,215

MINNESOTA

1	-1,313
2	-1,032
3	-1,209
4	-965
5	-799
6	-1,276
7	-1,135
8	-736
Total	-8,465

MISSISSIPPI

1	-1,198
2	-688
3	-744
4	-847
Total	-3,477

MISSOURI

1	-662
2	-944
3	-1,090
4	-790
5	-766
6	-1,021
7	-881
8	-1,010
Total	-7,164

MONTANA

At Large	-481

NEBRASKA

1	-840
2	-617
3	-820
Total	-2,277

NEVADA

1	-190
2	-486
3	-263
4	-211
Total	-1,150

NEW HAMPSHIRE

1	-927
2	-1,051
Total	-1,978

NEW JERSEY

1	-619
2	-498
3	-528
4	-517
5	-775
6	-732
7	-1,009
8	-755
9	-926
10	-455
11	-849
12	-834
Total	-8,497

NEW MEXICO

1	-384
2	-301
3	-305
Total	-990

NEW YORK

1	-506
2	-762
3	-401
4	-369
5	-313
6	-326
7	-459
8	-211
9	-228
10	-340
11	-274
12	-343
13	-291
14	-355
15	-237
16	-265
17	-427
18	-533
19	-589
20	-495
21	-655
22	-841
23	-1,076
24	-794
25	-949
26	-740
27	-1,089
Total	-13,868

NORTH CAROLINA

1	-868
2	-1,049
3	-559
4	-614
5	-1,107
6	-1,110
7	-831
8	-1,110
9	-837
10	-1,323
11	-933
12	-754
13	-937
Total	-12,032

NORTH DAKOTA

At Large	-594

OHIO

1	-1,034
2	-1,038
3	-611
4	-1,683
5	-1,637
6	-1,001
7	-1,510
8	-1,468
9	-1,063
10	-860
11	-716
12	-893
13	-1,165
14	-1,436
15	-803
16	-1,273
Total	-18,191

OKLAHOMA

1	-958
2	-881
3	-706
4	-613
5	-565
Total	-3,723

OREGON

1	-1,425
2	-626
3	-876
4	-693
5	-759
Total	-4,379

PENNSYLVANIA

1	-470
2	-294
3	-1,167
4	-1,196
5	-1,108
6	-1,132
7	-913
8	-1,079
9	-913
10	-1,008
11	-918
12	-849
13	-754
14	-548
15	-1,134
16	-1,236
17	-1,009
18	-848
Total	-16,576

RHODE ISLAND

1	-657
2	-638
Total	-1,295

TABLE 2

The Effects of EPA Regulations on Manufacturing Jobs, by Congressional District

SOUTH CAROLINA	
1	-645
2	-716
3	-1,222
4	-1,203
5	-1,041
6	-646
7	-676
Total	-6,149

SOUTH DAKOTA	
At Large	-929

TENNESSEE	
1	-1,077
2	-748
3	-1,045
4	-1,202
5	-611
6	-993
7	-894
8	-991
9	-553
Total	-8,114

TEXAS	
1	-754
2	-931
3	-877
4	-890
5	-630
6	-942
7	-773
8	-711
9	-560
10	-827
11	-565
12	-883
13	-728
14	-896
15	-357
16	-450
17	-723
18	-713
19	-421
20	-385
21	-501
22	-792
23	-392
24	-825
25	-664
26	-802
27	-601
28	-301
29	-839
30	-601
31	-687
32	-801
33	-891
34	-307
35	-485
36	-999
Total	-24,504

UTAH	
1	-989
2	-647
3	-624
4	-851
Total	-3,111

VERMONT	
At Large	-789

VIRGINIA	
1	-455
2	-597
3	-692
4	-771
5	-783
6	-918
7	-507
8	-228
9	-923
10	-433
11	-285
Total	-6,592

WASHINGTON	
1	-1,043
2	-1,032
3	-781
4	-549
5	-527
6	-554
7	-668
8	-935
9	-886
10	-517
Total	-7,492

WEST VIRGINIA	
1	-568
2	-513
3	-333
Total	-1,414

WISCONSIN	
1	-1,566
2	-1,058
3	-1,301
4	-984
5	-1,621
6	-1,999
7	-1,408
8	-1,765
Total	-11,702

WYOMING	
At Large	-280

Source: Calculations based on data from the Heritage Foundation Energy Model and employment data from the U.S. Census Bureau, American Community Survey.

INDUSTRIAL COMMISSION OF NORTH DAKOTA

Jack Dalrymple
Governor

Wayne Stenehjem
Attorney General

Doug Goehring
Agriculture Commissioner

February 18, 2014

United States Environmental Protection Agency
Office of Ground Water and Drinking Water
1200 Pennsylvania Avenue, NW (MC-4606M)
Washington D.C. 20460

Re: **Comments for consideration on US EPA's Draft *UIC Class VI Program: Guidance on Transitioning Class II to Class VI Wells***

Dear Sir/Madam:

The North Dakota Industrial Commission (NDIC) is pleased to provide these comments on the draft "Underground Injection Control (UIC) Guidance on Transitioning Class II Wells to Class VI Wells" (EPA 816-P-13-004) released for comment December 12, 2013.

In addition to providing comments on the draft guidance, the NDIC is also formally requesting the United States Environmental Protection Agency (USEPA) reconsider the provision 40 CFR 144.19 Transitioning from Class II to Class VI and allow for public comment. These comments also serve as a request for reconsideration of the Federal Requirements under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells; Final Rule December 10, 2010, promulgated on December 24, 2010 (75 Federal Register 77230 to 77303).

Request to Reconsider 40 CFR 144.19 and Open for Public Comment

The NDIC respectfully requests USEPA reconsider 40 CFR 144.19 Transitioning from Class II to Class VI and provide an opportunity for public comment. This reconsideration request is based on the unlawful adoption of 40 CFR 144.19 which was adopted pursuant to public comment as described in the Class VI Final Rule Preamble (77243-77245 *H. How does this rule affect existing injection wells under the UIC program?*) without an opportunity for public comment. Changes may be made to a proposed rule based on the public comments received. *Shell Oil Co. v. E.P.A.*, 950 F.2d 741, 750 (D.C. Cir. 1991). However, any changes made to a final rule must be of a type that could have been reasonably anticipated by the public – a logical outgrowth of the proposal. *Id.*

The United States Court of Appeals describes the "logical outgrowth" test as follows:

> "A final rule is a logical outgrowth of the proposed rule 'only if interested parties should have anticipated that the change was possible, and thus

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> reasonably should have filed their comments on the subject during the notice-and-comment period.'" *Int'l Union, United Mine Workers of Am. v. Mine Safety & Health Admin.*, 626 F.3d 84, 94-95 (D.C. Cir. 2010) (quoting *Int'l Union, United Mine Workers of Am. v. Mine Safety & Health Admin.*, 407 F.3d 1250, 1259 (D.C. Cir. 2005)). Notice of agency action is "crucial to 'ensure that agency regulations are tested via exposure to diverse public comment, … to ensure fairness to affected parties, and … to give affected parties an opportunity to develop evidence in the record to support their objections to the rule and thereby enhance the quality of judicial review'." *Id.* at 95 (quoting *Int'l Union*, 407 F.3d at 1259).

Daimler Trucks N. Am. LLC v. EPA, 737 F.3d 95, 100 (D.C. Cir. 2013).

If the "logical outgrowth test" is not met, agencies must provide a second notice with an opportunity for public comment on the changes. *Paralyzed Veterans of Am. v. D.C. Arena L.P.*, 117 F.3d 579, 586 (D.C. Cir. 1997).

40 CFR 144.19 is not a logical outgrowth from the Class VI rule proposed for public review and comment on July 25, 2008 (the comment period for the proposed Class VI rule closed December 24, 2008). USEPA adopted 40 CFR 144.19 pursuant to comments it received and added the provision to the final rule published on December 10, 2010, without providing a second notice or opportunity for public comment. The adoption of this provision is a change in philosophy from the proposed rule to the final rule. USEPA stated in the preamble of the proposed rule, "injection of CO_2 for the purposes of enhanced oil and gas recovery (EOR/EGR), as long as any production is occurring, will continue to be permitted under the Class II program." The final rule preamble describes USEPA's change in philosophy from the proposal:

> "EPA proposed that the Class VI GS requirements would not apply to Class II ER wells as long as any oil or gas production is occurring, but would apply only after the oil and gas reservoir is depleted. Under the proposed approach, Class II wells could be used for the injection of CO_2, as long as oil production is simultaneously occurring from the same formation. The preamble to the proposal sought comment on the merits of this approach.
>
> Some commenters agreed with the proposed approach while others suggested that the approach did not adequately address risks posed to USDWs by injection operations transitioning from production to long-term storage of CO_2. A majority of commenters requested that EPA develop specific criteria for this transition.
>
> Consistent with these comments, EPA determined that owners or operators of wells injecting CO_2 in oil and gas reservoirs for GS where there is an increased risk to USDWs compared to traditional Class II operations using CO_2 should be required to obtain a Class VI permit, with some special

> consideration for the fact that they are transitioning from a well not originally designed to meet Class VI requirements."

The proposed rule provided that there would be no transition "as long as any oil or gas production is occurring". The final rule, however, creates a transition point which will take place while oil production is occurring. North Dakota did not anticipate this significant change to the rule and therefore was denied an opportunity to comment. 40 CFR 144.19 and this draft guidance clearly indicate that what is published in the final rule is not a logical outgrowth from what was originally proposed.

Guidance Attempts to Expand USEPA Authority:

This guidance document appears to be an attempt to expand the authority of the USEPA by overfiling State Class II primacy programs. Under the guidance, the Class II UIC program Director and/or the EOR project operator are potentially required to report any and all data that may be requested by the Class VI UIC program Director (as of September 7, 2011 USEPA Regional Administrators or USEPA Administrator). Furthermore, this guidance appears to expand the authority of the Class VI UIC program Director over a Class II program or a Class II operator by allowing the Class VI UIC program Director the authority to require additional information/data to make a determination whether the Class II project can continue or should be required to transition. The Class VI UIC program Director has no authority over the Class II UIC program Director, nor does the Class VI UIC program Director have authority over the Class II project owner or operator.

Interpretation of CFR

The NDIC strongly disagrees with USEPA's interpretation of 40 CFR 144.17 on page 6:

> *40 CFR 144.17 provides either the Class II or Class VI UIC Program Director with the authority to require that a Class II owner or operator "conduct monitoring, and provide other information as is deemed necessary to determine whether the owner or operator has acted or is acting in compliance with Part C of the SDWA or its implementing regulations." This could include requesting information needed to determine whether the injection may lead to an increased risk to USDWs relative to Class II operations.*

Allowing the Class VI UIC program Director to require the Class II owner or operator to *"conduct monitoring, and provide other information as is deemed necessary to determine whether the owner or operator has acted or is acting in compliance with Part C of the SDWA or its implementing regulations"*, would conflict with State Class II primacy where the State is the primary regulatory authority. This would be considered overfiling should the Class VI UIC program Director require a Class II owner or operator to report directly to USEPA.

The NDIC interprets 40 CFR 144.17 as allowing the UIC program Director the flexibility to require the owner or operator to establish and maintain records, make reports, conduct monitoring, and provide other information as it relates to the well class under its primacy authority; not as allowing the UIC program Director to overfile injection well classes it does not directly regulate (i.e. the Class VI UIC program Director has direct regulatory authority over the

Class VI UIC program and the Class II UIC program Director has direct regulatory authority over the Class II UIC program). The NDIC has administered the 1425 UIC program regulating Class II injection well activities in North Dakota since 1983. The USEPA currently administers the Class VI UIC program in North Dakota. Under North Dakota's Class II UIC program primacy agreement with USEPA it would be consider overfiling if USEPA bypassed the NDIC and attempted to directly regulate a Class II owner or operator. USEPA's interpretation of 40 CFR 144.17 can be construed as an attempt to expand the direct regulatory authority of the Class VI UIC program Director. The only way USEPA's interpretation would be permissible is if the Class II program and the Class VI program were regulated under the same primacy authority. Under Safe Drinking Water Act (SDWA) Part D – Emergency Powers, Section 1431 (a) the USEPA can enact its overfiling authorities, when a "State or local authorities have not acted to protect the health of such persons, [USEPA Administrator] may take such actions as he may deem necessary in order to protect the health of such persons." In the context of the UIC program, the USEPA does not have the authority to overfile a State administered Class II UIC program or directly regulate an operator of a carbon dioxide enhanced oil recovery project under the jurisdiction of a State administered Class II UIC program, unless the State Class II UIC program Director has not acted to protect USDWs or the health of such persons pursuant to the SDWA.

The NDIC strongly disagrees with USEPA's interpretation of 40 CFR 144.51(h) on page 6:

> *40 CFR 144.51(h) requires permittees to provide "any information which the Director may request to...determine compliance with [a] permit." This gives the Class II UIC Program Director the authority to include Class II permit provisions to gather information that may be needed in the future to determine whether the project meets the definition of a Class II well or whether re-permitting as a Class VI well is necessary.*

The USEPA interpretation appears to obscure the lines between the Class II UIC program and the Class VI UIC program. The USEPA interpretation of 40 CFR 144.51 (h) which grants the Class II UIC program Director the authority to include additional permit provisions for a future determination, appears to create a process to add Class VI requirements to a Class II permit. The NDIC interprets 40 CFR 144.51 (h) as allowing the UIC program Director the flexibility he/she may need to require "any information" pertaining to the determination of whether the operator is operating the injection well as permitted. The USEPA's interpretation appears to constitute an overfiling prior to any determination that the Class II UIC program Director has not acted to protect human health and the environment.

In addition, USEPA describes a "project" as meeting the definition of a Class II well. This is a common inaccuracy throughout the draft guidance where USEPA misapplies the term "project" when referring to individual wells. The SDWA and the UIC program do not grant USEPA the authority over enhanced recovery projects, nor does USEPA have authority over carbon dioxide storage projects. The USEPA authorities are limited to the injection well.

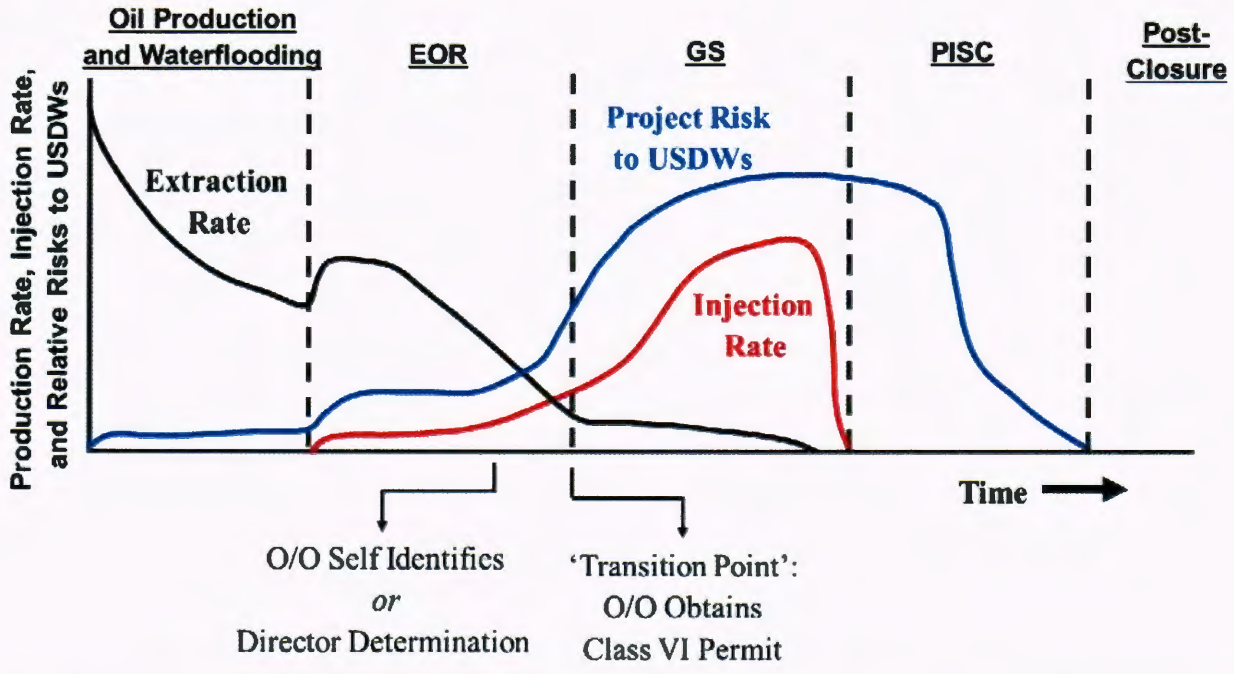
The NDIC recommends amending the above language as follows:

> *40 CFR 144.51(h) requires permittees to provide "any information which the Director may request to...determine compliance with [a] permit." ~~This~~ ~~gives~~ Upon the owner or*

operator expressing intent to transition to Class VI injection this provision allows the Class II UIC Program Director the authority to include Class II permit provisions to gather information that may be needed in the future to determine whether the project meets the definition of a Class II well or whether re-permitting as a Class VI well is necessary.

Hypothetical EOR Project Transitioning to a GS Project

The following diagram found on page 15 illustrates the transition point as taking place while oil production is occurring.



The NDIC requests further explanation of the specific parameters used to create this diagram as well as the data used to plot the graph and a description of why the injection rate increases as the extraction rate decreases. The NDIC is also requesting USEPA further explain the specific factors used in plotting project risk to underground sources of drinking water (USDWs); for example, does this diagram depict a specific geologic setting or is it a generalization of all EOR projects that transition into storage projects?

Traditional EOR

USEPA uses the term "traditional Class II operations" and "traditional EOR projects" when comparing increased risk to USDWs in a carbon dioxide enhanced oil recovery project. The word "traditional" should be defined, especially as the enhanced oil and gas recovery industry increases its use of anthropogenic carbon dioxide, explores potential "unconventional" oil reservoirs, and adapts to new technologies and modern approaches of oil recovery while simultaneously storing carbon dioxide.

Equally as Protective

Class II injection wells are equally protective of USDWs as compared to Class VI. USEPA states, "The Class VI requirements are more comprehensive and specific than the Class II requirements", but both well classes are designed to protect USDWs.

Individual Injection Well versus EOR/CCS Projects:

Throughout this guidance document USEPA uses the term "project" when referring to a carbon dioxide enhanced oil recovery Class II injection well or a Class VI carbon dioxide storage injection well. The context in which this guidance document refers to enhanced oil or gas recovery projects transitioning into geologic storage projects is beyond the authority of USEPA and the UIC program. The USEPA's authority is limited to the injection well. For example, the title of the guidance document describes the transition as "Class II Wells to Class VI Wells." The UIC program is defined in this guidance document as follows:

> **Underground Injection Control Program** refers to the program USEPA, or an approved state, is authorized to implement under the Safe Drinking Water Act (SDWA) that is responsible for regulating the underground injection of fluids by wells injection. This includes setting the federal minimum requirements for construction, operation, permitting, and closure of underground injection wells.

Throughout this guidance, USEPA mistakenly describes the transition from an injection well to a project and vice versa. For example on page 31, "Following a determination that there is an increased risk to USDWs from the injection project (see Section 3), owners or operators will need to apply for a Class VI permit." A project more than likely would consist of multiple injection wells, facilities, and potentially multiple types of wells (i.e. injection, production, and disposal).

The NDIC recommends USEPA replace "project" with "injection well" throughout this draft guidance, where appropriate.

Transitioning a Project from Mineral Rights to Storage Rights

The SDWA authority does not extend to private minerals or pore space ownership, further complicating the entire concept of transitioning a carbon dioxide enhanced recovery project to a carbon dioxide storage project. In North Dakota, the pore space is owned by the overlying surface estate rather than a severed mineral owner. The NDIC regulates the drilling and production of oil and gas in North Dakota with the mission:

> …to foster, to encourage, and to promote the development, production, and utilization of natural resources of oil and gas in the state in such a manner as will prevent waste; to authorize and to provide for the operation and development of oil and gas properties in such a manner that a greater ultimate recovery of oil and gas be had and that the correlative rights of all owners be fully protected; and to encourage and to authorize cycling, recycling, pressure maintenance, and secondary recovery operations in order that the greatest possible economic recovery of oil and gas be

> obtained within the state to the end that the landowners, the royalty owners, the producers, and the general public realize and enjoy the greatest possible good from these vital natural resources.

N.D.C.C. § 38-08-01

It is of great concern to the NDIC that the transition discussed in this USEPA guidance would potentially conflict with this agency's mission to prevent waste, maximize recovery, and fully protect correlative rights.

Sincerely,

Jack Dalrymple
Governor

Wayne Stenehjem
Attorney General

Doug Goehring
Agriculture Commissioner

Denbury

SUBPART RR FLAWS PRECLUDE EPA'S RELIANCE ON CO_2-EOR IN THE PROPOSED NSPS RULE

I. THE ROLE EPA EXPECTS CO_2-EOR TO PLAY UNDER THE NSPS RULE AND THE SUBPART RR REQUIREMENT

EPA's proposed NSPS rule relies on CCS as the "best system of emissions reduction" that has been "adequately demonstrated", a finding that is legally required by the relevant statute for EPA to adopt the emission standard. EPA's cost assessment of CCS is based in material part on the agency's expectation that "new fossil fuel-fired EGUs that install CCS will generally make the captured CO_2 available for use in EOR operations" and its belief that "use of EOR lowers costs for production of domestic oil."[1] Under the proposed rule, an *emitter may use* the EOR-based storage to meet the performance standard *only where the offsite injector reports* the CO_2 storage to EPA under Subpart RR of the GHG reporting rules.[2] This results in an emitter trying to enforce an EPA rule upon an EOR operator now only subject to Subpart UU of the GHG reporting rules. Under Subpart RR, an operator would have to submit and receive final approval of an MRV plan from the EPA following any appeals under Part 78 and subsequent judicial review.[3] This means that approval of an MRV plan is likely to be delayed and then finally determined through litigation. The proposed NSPS rule would thus impose federal regulation on drilling and subsurface operations of the oil and gas industry via rules applied to air emissions by electricity generating units.

II. THE SUBPART RR PROBLEM: THE CONFLICTING OBJECTIVES OF RESOURCE CONSERVATION AND WASTE DISPOSAL

Contrary to EPA's expectations, the proposed NSPS rule will ***foreclose – not encourage*** -- the use of CO_2 captured by emissions sources in EOR operations. The reason is that compliance with Subpart RR will transform an EOR operation from a resource recovery operation into a waste disposal operation. Subpart RR compliance will create regulatory uncertainty and risk that will result in EOR operators avoiding the purchase of CO_2 that is subject to those rules. Operators will likely prohibit CO_2 suppliers from commingling "Subpart RR CO_2" with other CO_2 supplies being transported for EOR operations. Indeed, the EOR offtake agreements underlying the existing projects upon which EPA relies to show that CCS has been "adequately demonstrated" would not have been entered into if Subpart RR compliance had been required. In sum, requiring Subpart RR compliance by the EOR operator in order for the emitter to meet the NSPS standard will in fact foreclose the development of capture projects that would otherwise include EOR offtake agreements.

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[1] Proposed Rule at 262-263. See also at 272 (EPA expects that for the immediate future, captured CO_2 from affected units will be injected underground for geologic sequestration at sites where EOR is occurring).

[2] Proposed Rule, at 279 (if the captured CO_2 is injected offsite, then "the facility injecting the CO2 underground must report under . . . subpart RR".

[3] To be codified at 40 C.F.R. § 60.46Da(h)(5)(ii).

1. Subpart RR compliance will conflict with state mandates to conserve natural resources, prevent waste and protect correlative rights. The touchstones of state oil and gas law (including a number of State Constitutional mandates) are the conservation of natural resources, the prevention of waste and the protection of the correlative rights of all the affected mineral interest owners. Generally speaking, "waste" means operating wells in a way that reduces the total ultimate recovery of the resource. These legal principles are fundamental to countless commercial oil and gas industry agreements – mineral leases, unit or pooling agreements, operating agreements, and royalty agreements, to name but a few. Operators must prudently and diligently develop resources under mineral leases and avoid damaging the reservoirs or otherwise reducing the total ultimate recovery of the resource. For example, in Texas, the conservation and development of all natural resources is a "public right and duty" and the preservation of the State's natural resources "is an issue of constitutional dimension".[4]

In contrast, the EPA's rules and policies governing CO_2 storage for emissions reduction purposes are premised on a "waste disposal" model (which is why EPA based the Class VI geologic sequestration rules on the rules for Class I, waste disposal wells). Under the NSPS framework, CO_2 injectate is viewed as a waste to be permanently stored rather than a commodity to be used to maximize total ultimate recovery of the hydrocarbon resource. The whole thrust of EPA's reliance on CCS as an emissions reduction technology under the proposed NSPS rule will be focused on the goal of reducing emissions. Waste disposal considerations will permeate the entire closed loop CO_2 recycle system and transportation network, and will preclude future timely access to the remaining oil at the end of an EOR operation. Interfering with, delaying implementation of, and therefore reducing the total ultimate recovery of remaining oil from an EOR operation will constitute the "waste" of resources that is contrary to, and expressly prohibited by, state conservation law (including Constitutional law) as well as upsetting countless commercial agreements. While no one knows what an EPA-approved MRV plan may ultimately require (as explained below), operators are not going to risk acceptance of a plan that is counter to its duty as a prudent operator to conduct itself in a manner to increase the recovery of remaining resources.

Regulatory conditions that are onerous, restrictive, expensive, or technologically challenging will constitute substantial barriers for a prudent operator who must continually manage and change its injection operations for its developed projects in order to maximize the recovery of the remaining mineral resources. Such regulatory restrictions on the future recovery of remaining mineral resources will generate mineral property "takings" claims that thus far are fairly rare today, but could dominate the landscape under the proposed NSPS structure.

2. *Subpart RR is not merely a reporting rule, but is a vehicle for litigation-based, substantive regulation under the undefined MRV plans.* Subpart RR is not merely a reporting rule. It requires the operator to obtain approval by the EPA of a "monitoring, reporting and verification" plan. Absent an approved MRV plan, the operator will not be allowed to inject the CO_2. And, if a plan is approved, such plan must be maintained

[4] *Exxon Corporation, et al. v. Laurie T. Miesch et al.*, 180 S.W. 3d 299, 318 (Tex. App. 2005).

under the rule for a duration determined by the EPA, and not the EOR operator. Once a plan is administered, only the EPA can determine its closure; this in itself is an unacceptable scenario for the mineral interest owners who must wind down their activities when the purpose of the enhanced recovery of oil has come to an end. Moreover, there are no standards governing what may constitute an incomplete or otherwise unacceptable plan, nor any timeline for approval, creating a completely open-ended and undefined regulatory framework. Nevertheless, failure to monitor or report data according to the ultimately-approved MRV plan is subject to EPA enforcement action under the Clean Air Act,[5] penalties for which can be substantial.

Subpart RR further provides that operational changes -- even the drilling of a new injection well that had not previously been identified – can start the whole MRV approval process over again. It is important to remember that an EOR operation is a dynamic process that involves the drilling of multiple wells, the reconfiguration of wells from injectors to producers or vice versa, as well as adapting the original plans to respond to operational changes. This means that there will ***necessarily*** be a host of changes to the originally-approved plan. Any one of these changes may be sufficiently material to trigger the MRV approval process again.

These aspects of Subpart RR regulation mean that the developer of a generating project that is planning to transfer captured CO_2 for EOR operations will have no assurance that it will have an outlet for the to-be-captured CO2 until after litigation of the EOR operator's MRV plan is complete. It must further face that risk that subsequent operational changes by the EOR operator may trigger revisions to the MRV plan that prevent the EOR operator from approved reporting -- thereby jeopardizing compliance with the NSPS performance standards *by the emitting generating unit*. This could force the shutdown of the generation plant.[6]

EPA's reliance on Subpart RR compliance thus imposes severe regulatory barriers to the use of EOR-based storage to meet the NSPS standards. It is difficult to see how a project could be successfully developed, financed, and constructed under these rules.

3. *To avoid these conflicts, risks, and uncertainties, EOR operators are unlikely to either purchase "Subpart RR CO_2" or even to allow such gas to be commingled for transportation with ordinary CO_2.* While developers of proposed power plants designed to meet the proposed NSPS standard will expect potential purchasers to commit to become subject to Subpart RR, EOR operators will decline, because the restrictions, costs, risks, and uncertainties associated with Subpart RR status will make those supplies of CO_2 totally undesirable. Moreover, CO_2 pipeline operators may be expected to prevent the commingling of "Subpart RR CO_2" with ordinary CO_2 because of the fear

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[5] EPA's Response to Comments, at 175. *See also* at 14.

[6] *See e.g.* Condition GHG-3 of California Energy Commission's Preliminary Staff Assessment and Draft EIS (docketed June 28, 2013 in Docket 08-AFC-8A) for a CCS project in that state would require the emitting power generation unit to cease operations if it is unable to demonstrate compliance with the emissions performance compliance plan or if the EOR operator permanently stops accepting CO2 for sequestration.

that the Subpart RR obligations will apply to the entire commingled stream (exactly as federal courts held that federal natural gas regulation applied to an entire commingled stream even where nearly all of the gas stream was intrastate in nature and not otherwise subject to federal regulation).[7]

As a result, the proposed NSPS rule makes it extremely unlikely that developers of proposed coal-fired projects will be able to enter into commercially-based offtake agreements with EOR operators for the to-be-captured CO_2. Indeed, the EOR offtake agreements underlying the *existing* power generation project upon which EPA relies to show that CCS has been "adequately demonstrated" would not have been signed if the now-proposed NSPS rule and mandated Subpart RR compliance had been in effect when those projects were finalized.

4. *None of the 1,000 million metric tons of CO_2 injected to date have been subject to Subpart RR*. Nearly 1,000 million metric tons of CO_2 have been successfully injected during EOR operations in the United States over the last forty years, representing a vast amount of actual experience and expertise with CO_2 injection and incidental storage during EOR operations. Of these 1,000 million tons, roughly 120 million have been reported to the EPA since the reporting rules took effect beginning in 2011, all of which has been reported under Subpart UU and not a single ton has come under the Subpart RR rules. There are no approved MRV plans for CO_2 injection in EOR operations for reporting under Subpart RR. Hence, rather than being "adequately demonstrated", the Subpart RR rules and procedures are unused, uncertain and unworkable for EOR operations.

[7] This concern was recognized in the 2010 report of the IOGCC's Pipeline Transport Task Force on CO_2 transportation.

NATURAL RESOURCES DEFENSE COUNCIL

Comments on

Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units

77 Fed. Reg. 22,392 (April 13, 2012)

Comments on Measures Needed to Assure the Integrity of Carbon Capture and Storage in the Power Plant New Source Performance Standards

submitted by

Natural Resources Defense Council

June 25, 2012

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I. Introduction

We thank the Environmental Protection Agency (EPA) for the opportunity to comment on the proposed carbon pollution standards for new power plants. These comments are directed to requirements needed to assure the integrity of carbon capture and storage (sequestration) as a compliance option under the rule.

The Natural Resources Defense Council (NRDC) is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and online activists nationwide, served from offices in New York, Washington D.C., San Francisco, Los Angeles, Chicago and Beijing.

II. Treatment of CCS under the proposed rule's compliance obligations

(1) General discussion

The proposed rule defines CCS as follows: "Carbon capture and storage (CCS) means a process that includes capture and compression of CO_2 produced by an electric utility generating unit before release to the atmosphere; transport of the captured CO_2 (usually in pipelines); and storage of that CO2 in geologic formations, such as deep saline formations, oil and gas reservoirs, and unmineable coal seams".[1] The proposed rule clearly lists CCS as a compliance option and lists specific standards to be met by the EGU in the case that CCS is used towards compliance.[2]

We submit that EPA's standards must include provisions to address the risk of CO_2 leakage after CO_2 captured at the plant site leaves the site to be transported to, and disposed of in, a sequestration facility. To this end, the standards need to include (directly or by reference) requirements that captured CO_2 must be transported through approved pipelines to approved sequestration sites, where both the pipelines and sequestration sites are subject to appropriate requirements for preventing emissions, and for monitoring, quantifying, and reporting to detect and correct any such emissions. The standards must specify that an EGU source may subtract captured CO_2 from its reported CO_2 emissions only if these provisions are complied with.

CCS systems necessarily involve equipment and facilities beyond the EGU plant site. It would be utterly unacceptable for an EGU to capture CO_2 and pipe it off-site, only to have it released from the open end of a pipe across the fence-line. Thus, at a minimum, an EGU must not be allowed to deduct captured CO_2 from its emissions unless it has, and complies with, an

[1] 77 Fed. Reg. 22439.
[2] 77 Fed. Reg. 22436-22437.

enforceable commitment to ship that CO_2 by a pipeline operating in compliance with containment, monitoring, and reporting requirements, to a sequestration facility that in turn operates in compliance with containment, monitoring, and reporting requirements.

Accordingly, unless the owners and operators of the receiving pipelines and sequestration facilities are subject to obligations to monitor and report CO2 emissions and are subject to noncompliance penalties no less stringent than those applicable to covered NSPS facilities under the Clean Air Act, any release from such pipelines and sequestration facilities of CO2 produced by a covered EGU must be attributed to the covered EGU for NSPS compliance purposes.

Further, EPA needs to adopt, directly in this rule or by reference, appropriate and specific standards for containing, monitoring, quantifying and reporting emissions from pipelines and sequestration facilities. Only upon compliance with such requirements shall the EGU be allowed to deduct sequestered CO_2 from its own emissions.

(2) EPA's Greenhouse Gas Reporting Rule and compliance with the proposed rule

With appropriate improvements, the CCS-related requirements of EPA's Greenhouse Gas Reporting Rule could form the basis of the provisions needed in the standards to set forth the compliance obligations of EGU sources that employ CCS systems. While EPA has adopted a general Greenhouse Gas Reporting Rule, that rule is not adequate on its own to assure compliance with the NSPS for EGUs. We address some of the needed improvements below.

Subparts UU and RR of the Greenhouse Gas Reporting Rule apply to facilities that inject and geologically sequester CO_2 respectively.

We do not consider reporting under subpart UU to be sufficient to assure compliance with the proposed NSPS, given that it amounts to no more than reporting meter readings and does not consider the potential for emissions from sequestration sites. EPA should not accept reporting under subpart UU of the Greenhouse Gas Reporting Rule by itself as sufficient for the purposes of compliance of CCS facilities under the proposed rule.

Subpart RR applies to facilities that geologically sequester CO_2 and includes additional obligations over subpart RR to identify CO_2 leakage pathways (including likelihood, magnitude and timing), delineate the monitoring area, identify a strategy for detecting and quantifying any surface leakage of CO_2, and identify a strategy for establishing expected baselines for monitoring CO_2 surface leakage.

However, reporting under subpart RR is not mandatory for all CO_2 injection facilities – only for wells that inject CO2 under Class VI of the Underground Injection Control Program (UIC). Furthermore, compliance with subpart RR by itself does not guarantee that adequate standards are met in order to satisfy the higher level of compliance requirements that are needed to effectively enforce the proposed rule, for several reasons. First, the requirements under

subpart RR are general, and could be implemented very differently depending on the discretion of the Administrator. Second, Monitoring, Reporting and Verification (MRV) plans are reviewed on an individual basis and are not made public until finalized, with only an ex-post option for appeal to the Environmental Appeals Board for interested parties. Third, reporting under subpart RR does not require or guarantee that geologic sequestration sites are sited, operated and decommissioned in a way that will aim to prevent or minimize leaks to the atmosphere. The requirement is merely to report any emissions.

For these reasons, EPA should not accept reporting under subpart RR of the Greenhouse Gas Reporting Rule by itself as sufficient for the purposes of compliance of CCS facilities under the proposed rule. The informational and general nature of the Reporting Rule renders it unsuitable by itself for compliance with the proposed rule.

(3) UIC well classes and compliance with the proposed rule

We do believe that reporting under subpart RR could be used for compliance under the NSPS if combined with other EPA regulatory requirements. In particular, we believe that EGUs should be allowed to subtract from their on-site atmospheric emissions quantities of CO_2 that are being injected and sequestered (minus any leaks) in wells permitted under UIC Class VI (which makes reporting under subpart RR compulsory). However, we do not believe that the same should be allowed if CO_2 is being injected in Class II wells.

Class II dates back several decades and is used for injecting brines, CO_2 and other fluids associated with oil and gas production, and hydrocarbons for storage.[3] Class VI is a new injection well class, which was designed specifically for and applies to wells that inject CO_2 for geologic sequestration.[4] Class VI rules are far more recent than Class II rules, and were promulgated in December 2010.

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[3] 40CFR144.6(b) defines Class II wells as "[w]ells which inject fluids:
(1) Which are brought to the surface in connection with natural gas storage operations, or conventional oil or natural gas production and may be commingled with waste waters from gas plants which are an integral part of production operations, unless those waters are classified as a hazardous waste at the time of injection.
(2) For enhanced recovery of oil or natural gas; and
(3) For storage of hydrocarbons which are liquid at standard temperature and pressure.

[4] 40CFR 144.6(f) defines Class VI wells as "[w]ells that are not experimental in nature that are used for geologic sequestration of carbon dioxide beneath the lowermost formation containing a USDW; or, wells used for geologic sequestration of carbon dioxide that have been granted a waiver of the injection depth requirements pursuant to requirements at §146.95 of this chapter; or, wells used for geologic sequestration of carbon dioxide that have received an expansion to the areal extent of an existing Class II enhanced oil recovery or enhanced gas recovery aquifer exemption pursuant to §§146.4 of this chapter and 144.7(d)."

Regulatory requirements for Class VI are more comprehensive than for Class II on many counts. Below we summarize some key differences:

- The information than needs to be submitted at the time of a permit application is more extensive under Class VI. For example, key geological, geomechanical, lithological and geochemical properties of the confining zone, information on faults or fractures that may interfere with confinement, seismic history, and information on wells with the area of review have to be submitted under a Class VI permit application. Class II does not have such requirements, or requires only information on known wells that is of public record rather than the use of methods to discover orphaned or abandoned wells.
- Class VI siting requirements include an injection zone with sufficient properties to receive the total anticipated volume of CO_2 injectate, a confining zone big enough to contain injected *and* displaced fluids, and with sufficient integrity to allow injection without initiating or propagating fractures. Class II requires only a confining zone that is free of transmissive faults and fractures.
- Monitoring requirements for Class II are limited to analyzing injected fluids with sufficient frequency to yield data representative of its chemical and physical characteristics, as well as injection rate, pressure and volume measurements. Class VI requirements include an extensive testing and monitoring plan that covers operational parameters for the well, direct and indirect methods to track the extent of the CO_2 plume and the area of elevated pressure, water quality measurements, as well as surface monitoring if required by the Director.
- Class VI requirements for a well plugging plan are tailored to individual situations rather than requiring off-the-shelf methods to be used.
- Class II lacks any post-injection site care and site closure requirements. Class VI requires post-injection monitoring for fifty years, or an alternative period if it can be shown that it is sufficient, in order to establish the evolution of the injected CO_2 and displaced fluids, and that no USDWs are being endangered. Once no endangerment established, then the Director may authorize site closure, at which point financial responsibility obligations cease.
- The area of review and corrective action requirements for Class VI are broader. The actual area of review does not rely on default distances, needs to be updated at least every five years, requires modeling of certain specifications to determine the extent of the CO_2 plume and displaced fluids, and more extensive identification of penetrations within the area of review. A revision of the area of review also may require revision of other required plans.
- Financial responsibility obligations under Class VI are more comprehensive than under Class II.

40CFR146.81(d) states that "Geologic sequestration means the long-term containment of a gaseous, liquid, or supercritical carbon dioxide stream in subsurface geologic formations. This term does not apply to carbon dioxide capture or transport."

- Class VI emergency and remedial response provisions require actions by the owner or operator to address movement of the injection or formation fluids that may cause an endangerment to a USDW during construction, operation, and post-injection site care periods. Class II has no such requirements.
- Construction requirements, as well as requirements for logging, sampling and testing, go further in Class VI than they do in Class II.
- The standard for granting primacy to states for the implementation of the program is weaker for Class II wells, and consists of a general effectiveness demonstration as opposed to meeting individual stringency and adequacy criteria.

Class VI therefore contains comprehensive requirements tailored to geologic sequestration projects that aim to ensure that CO_2 does not contaminate groundwater. Preventing groundwater contamination serves the purpose of reducing the likelihood that injected CO_2 will enter the atmosphere. On the other hand, injection under Class II permits combined with reporting under subpart RR could leave substantial gaps in terms of safeguards for effective sequestration of CO_2, which would seriously compromise compliance under the proposed rule.

EPA should allow EGUs to show compliance with the standards of the proposed rule by subtracting from their atmospheric emissions CO_2 that is being injected and sequestered (minus any leaks) in wells permitted under UIC Class VI and that report their emissions under subpart RR.

Further, EPA should consider establishing a compliance demonstration pathway for sequestration facilities that are not covered by Class VI permits.

We believe that EPA should propose and finalize requirements to classify carbon dioxide that is captured and injected during enhanced hydrocarbon recovery operations as geologically sequestered if it determines that conditions for site selection, operation, mitigation, remediation, monitoring, reporting and abandonment are met that will ensure minimum risk of, and appropriate response to, potential leakage from the intended carbon dioxide confinement zone.

EPA regulations establishing requirements for qualifying carbon dioxide injected in Enhanced Hydrocarbon Recovery operations as geologic sequestration should include but not be limited to the following:

- A demonstration that sites are capable of long-term containment of carbon dioxide;
- Identification and characterization of potential natural and man-made leakage pathways, and appropriate risk management and corrective actions;
- Design, construction and operation parameters to prevent, mitigate and remediate the creation or activation of leakage pathways, or and the migration of CO_2 or fluids into any zone in a manner not authorized by the Administrator (or pursuant to a State program approved by the Administrator as meeting the requirements of these regulations);

- Minimizing fugitive CO_2 emissions from project operations;
- Monitoring and modeling to predict and confirm the position and behavior of the CO2 and other fluids in the subsurface during and after injection;
- Accounting and reporting of CO_2 quantities sequestered, injected, recycled, leaked, vented, and any other categories as appropriate; and,
- Post-injection site closure and financial responsibility requirements that ensure the long-term containment of injected CO_2.

Pending the promulgation or revision of such regulations by EPA, the Agency should approve applications for qualification of carbon dioxide injected in Enhanced Hydrocarbon Recovery operations as geologically sequestered for the purposes of the proposed rule pursuant to guidelines that conform to the requirements above.

(4) Carbon Capture and Storage Needs to be Further Defined to Assure Permanent Sequestration

As noted above, EPA needs to refine the definition of carbon capture and storage to assure permanent sequestration. We suggest that EPA add the word "permanent" to the proposed definition of CCS:

> Carbon capture and storage (CCS) means a process that includes capture and compression of CO2 produced by an electric utility generating unit before release to the atmosphere; transport of the captured CO2 (usually in pipelines); and *permanent* storage of that CO2 in geologic formations, such as deep saline formations, oil and gas reservoirs, and unmineable coal seams.

Further, EPA should define geologic sequestration consistently with its Safe Drinking Water Act regulations to mean the permanent containment of a gaseous, liquid, or supercritical carbon dioxide stream injected in subsurface geologic formations that are shown to have the suitable characteristics necessary to provide such containment, under operating and abandonment conditions, and requirements designed to ensure and verify such containment, as determined by the Administrator.

III. Conclusion

We thank EPA for the opportunity to comment on the proposed rule. NRDC continues to believe strongly that geologic sequestration of CO2, correctly implemented, must be a component of the U.S. climate mitigation portfolio. However, the proposed carbon pollution standards for new power plants must ensure that the technology is deployed safely and effectively, and must not create a precedent whereby emitters are allowed to treat carbon dioxide that is captured, transported and sequestered without the appropriate safeguards that will ensure that it is not emitted to the atmosphere and that it does not endanger human health or the environment.

Opening Statement of Janet McCabe
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

Hearing on the Science of Capture and Storage: Understanding EPA's Carbon Rules

Subcommittee on Energy and Subcommittee on Environment
Committee on Science, Space, and Technology
U.S. House of Representatives
March 12, 2014

Chairmen Schweikert and Lummis, Ranking Members Bonamici and Swalwell, members of the Committee: Thank you for the opportunity to testify today.

Climate change is one of the greatest challenges of our time. Our changing climate already threatens human health and welfare and economic well-being, through the increased intensity and frequency of severe heat waves, a rise in sea level affecting our coastal businesses and communities, and a combination of rising temperatures and changing precipitation that leads to increased droughts and wildfires. If left unchecked, continued emissions of greenhouse gases and the resulting, measurable increase of their concentration in the atmosphere will have devastating impacts on the United States and the planet. Reducing carbon that is being emitted into the atmosphere is

critically important to the protection of Americans' health and the environment upon which our economy depends.

Last June, President Obama issued a national Climate Action Plan, which directs the EPA and other federal agencies to take steps to mitigate the current and future damage caused by greenhouse gas emissions and to prepare for the climate changes that have already been set in motion. A key element of the plan is addressing carbon pollution from new and existing power plants in the United States. Our changing climate is also a global challenge, and the President's Plan recognizes that the United States must couple action at home with leadership abroad.

Cutting Carbon Pollution

Today you have asked me to focus on the critical role EPA plays in implementing one of the central activities in the Climate Action Plan: cutting carbon pollution from new power plants.

Power plants are the single largest source of carbon pollution in the United States, accounting for roughly one-third of all domestic greenhouse gas emissions. In March of 2012, the EPA first proposed carbon pollution standards for future power plants. After receiving over 2.5 million comments, we determined to issue a new proposed rule based on this input and on updated information.

In September of 2013, the EPA announced its new proposal. The proposed standards would set the first uniform national standards for carbon pollution from future power plants. They will not apply to existing power plants. The proposal would set separate national limits for new natural gas-fired turbines and new coal-fired units. New large natural gas-fired turbines would need to emit less than 1,000 pounds of CO2 per megawatt-hour, while new small natural gas-fired turbines would need to emit less than 1,100 pounds of CO2 per megawatt-hour. New coal-fired units would need to emit less than 1,100 pounds of CO2 per megawatt-hour. Operators of these units could choose to have additional flexibility by averaging their emissions over multiple years to meet a somewhat tighter limit.

These standards, which are proposed under Section 111 of the Clean Air Act, are based on an evaluation of the technology that is available to limit carbon pollution emissions at new power plants. EPA proposed these standards by following a well-established process to determine the "best system of emission reduction … adequately demonstrated" to limit pollution, or BSER.

In the proposal, the EPA determined that the best system of emission reduction for new coal units is a new efficient unit implementing partial carbon capture and storage (CCS). The EPA based this determination on a review of (1) existing projects that implement

CCS; (2) existing projects that implement various components of CCS; (3) planned CCS projects; and (4) scientific and engineering studies of CCS. The determination relies on a wide range of data, information, and experience.

These proposed standards reflect the demonstrated performance of efficient, lower carbon technologies that are currently being used today. They set the stage for continued public and private investment in technologies like efficient natural gas and carbon capture and storage. The proposal was published in the Federal Register on January 8, and the formal public comment period is now open. We recently extended the comment period, to May 9, to ensure we get as much public input as practicable. We look forward to robust engagement on the proposal and will carefully consider the comments we receive as a final rule is developed. We continue to review information as it becomes available as well, working with the Department of Energy and other agencies with expertise in these issues. We know there is great interest in our proposal, and great interest in our review of CCS. These opportunities for discussion and making sure EPA has the best information available are what the notice and comment process is all about.

As noted, the proposed rule would apply only to future power plants. For existing plants, we are engaged in extensive and vigorous

outreach to a broad group of stakeholders, including states, who can inform the development of proposed guidelines. EPA expects to issue these proposed guidelines by June of this year. These guidelines will provide guidance to States, which will have the primary role in developing and implementing plans to address carbon pollution from the existing plants in their states. We recognize that existing power plants require a distinct approach, and this framework will allow us to capitalize on state leadership and innovation while also accounting for regional diversity and providing flexibility.

Conclusion

Responding to climate change is an urgent public health, safety, national security, economic, and environmental imperative that presents great challenges and great opportunities. As the President and Administrator McCarthy have stated, both the economy and the environment must provide for current and future generations. We can and we must embrace cutting carbon pollution as a spark for business innovation, job creation, clean energy, and broad economic growth. The continued global leadership of the United States and the success of the Clean Air Act over the past 40 years make it clear that public health protection and economic growth go hand in hand.

Thank you again for the opportunity to testify. I look forward to answering your questions.

Janet McCabe, Acting Assistant Administrator for the Office of Air and Radiation

Janet McCabe is the Acting Assistant Administrator for the Office of Air and Radiation, having previously served as OAR's Principal Deputy to the Assistant Administrator.

Prior to joining EPA in November 2009, McCabe was Executive Director of Improving Kids' Environment, Inc., a children's environmental health advocacy organization based in Indianapolis, Indiana and was an adjunct faculty member at the Indiana University School of Medicine, Department of Public Health.
From 1993 to 2005, Ms. McCabe held several leadership positions in the Indiana Department of Environmental Management's Office of Air Quality and was the office's Assistant Commissioner from 1998 to 2005. Before coming to Indiana in 1993, Ms. McCabe served as Assistant Attorney General for environmental protection for the Commonwealth of Massachusetts and Assistant Secretary for Environmental Impact Review.

Ms. McCabe grew up in Washington, D.C. and graduated from Harvard College in 1980 and Harvard Law School in 1983.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

January 29, 2014

EPA-SAB-14-003

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Subject: Science Advisory Board (SAB) Consideration of EPA Planned Actions in the Spring 2013 Unified (Regulatory) Agenda and their Supporting Science

Dear Administrator McCarthy:

As part of its statutory duties, the Science Advisory Board (SAB) recently concluded a series of discussions about possible review of the science supporting major EPA planned actions. The EPA Office of Policy provided notice of release of the Spring 2013 Semiannual Regulatory Agenda on July 3, 2013. Since that time, the SAB held a public meeting on December 4-5, 2013 and public teleconference on January 21, 2014 to discuss whether to review the science supporting any of the planned regulatory actions in that agenda in order to provide advice and comment on the adequacy of the science, as authorized by section (c) of the Environmental Research, Development and Demonstration Authorization Act.

The SAB appreciates the information provided by the EPA Office of Policy and the EPA program offices describing the planned actions, associated scientific questions, and agency plans for scientific analyses and peer review. The SAB also appreciates information provided by the public regarding the planned actions. The written information provided and the results of fact-finding discussions with EPA Staff are available on the SAB website.

The SAB focused its attention on 11 major actions identified by the EPA Office of Policy as being planned but not yet proposed as of the date the Semiannual Regulatory Agenda was published in the *Federal Register* on July 3, 2013. After discussions held at the public meeting on December 4-5, 2013 and the public teleconference on January 21, 2014, the SAB decided that it will not undertake review of the science supporting any actions in the semi-annual regulatory

agenda at this time. However, the SAB wishes to communicate three important points related to the review of major planned actions included in the Spring 2013 Semiannual Regulatory Agenda.

First, in regard to the planned action entitled *Revision of 40 CFR Part 192 -- Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In Situ Leaching Processing Facilities* (2060-AP43), the SAB wishes to evaluate the science supporting the proposed rule after it is proposed, when more information about the proposed rule and the science supporting it are made available. At that time the SAB will determine whether it wishes to offer advice and comment to the Administrator. The SAB made this decision because there was insufficient information provided by the agency to date about the scientific and technical basis for this planned action.

Second, in regard to the action entitled *Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generation Units* (2060-AQ91), the SAB defers to EPA's legal view, communicated to the SAB by staff from EPA's Office of Air and Radiation, that the portion of the rulemaking addressing coal-fired power plants focuses on carbon capture and that the regulatory mechanisms for addressing potential risks associated with carbon sequestration are not within the scope of the Clean Air Act. Carbon sequestration, however, is a complex process, particularly at the scale required under this rulemaking, which may have unintended multi-media consequences. The Board's strong view is that a regulatory framework for commercial-scale carbon sequestration that ensures the protection of human health and the environment is linked in important systematic ways to this rulemaking. Research and information from the EPA, Department of Energy, and other sources related to carbon sequestration merit scientific review by the National Research Council or the SAB. Indeed, the Board notes that Section 704 of the Energy Independence and Security Act of 2007 directly calls for the National Research Council to review such research conducted by the Department of Energy and that this review has not yet occurred. The SAB asks the EPA to explore options for conducting such a review in a timely manner. The Board also advises the agency to monitor technological progress on carbon capture as the regulation is implemented.

Third, and more generally, the SAB is seeking ways to improve the process for future review of the semi-annual regulatory agenda. The Board requests that the EPA describe in a more complete and consistent manner the scientific and technological bases for major planned actions and associated peer review. More complete and timely agency information when the Board begins considering the regulatory agenda will enable the SAB to make informed decisions in an expeditious manner about whether to provide advice and comment on science supporting planned agency actions. The SAB Staff Office will be meeting soon with EPA program offices to discuss improved processes to provide the SAB with the information needed for the Board's deliberations.

On behalf of the SAB, I thank you for the opportunity to support EPA through consideration of the science supporting actions in the agency's regulatory agenda.

Sincerely,

//s//

Dr. David T. Allen, Chair
Science Advisory Board

Enclosure

(1) Roster of SAB Members

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SCIENCE ADVISORY BOARD STAFF

Dr. Angela Nugent, Designated Federal Officer, U.S. Environmental Protection Agency, Washington, DC,

Response By Robert Hilton To Hearing Questions From the US House of Representatives Committee on Science, Space, and Technology

Subcommittee on Environment

Subcommittee Energy

Science of Capture and Storage: Understanding EPA's Carbon Rules

1. As an engineer, and representing a company that stands to profit through the sale of CCS technologies, do you believe CCS has been "adequately demonstrated" in full scale power plant applications and is Alstom offering standard commercial guarantees for this technology.

Answer: No, the technology has not been "adequately demonstrated" in full scale in power plants and Alstom is not offering standard commercial guarantees for this technology.

a. In your experience, will power providers invest in emissions control technologies that aren't backed by standard performance guarantees?

Answer: No, power providers expect performance guarantees including removal performance , power consumption, consumables consumption and other performance guarantees as well as larger guarantees like reliability, availability and other guarantees.

b. If an emissions technology does not perform "as advertised", what are the implications for the power provider? What are the implications for a company like Alstom?

Answer: Since the capture system will be part of the environmental permit, failure to preform would result in significant fines and the shutting down of the plant until remedies are executed. For a company like Alstom, we could, depending on the contract, be responsible for damages such as the cost of lost power production, value associated with failure to provide CO2 to an end user who had contracted for the CO2, if they exist, and other potential liquidated or consequential damages.

2. In the proposed rule, EPA claims that the use of CCS "components" at non-power plant industrial facilities proves that the full scale integrated CCS systems are adequately

demonstrated for commercial power plants. But in 2010 EPA co-drafted a report concluding that "the integration of CO2 capture, transportation, and permanent sequestration at commercial scale, coal-fired power generating facilities has not yet been demonstrated". Do you believe the literature supports EPA's position that the integration of CCS components has been demonstrated when the research sites appear to say the opposite?

Answer: No. The greatest risk in all chemical processes is the integration of the components at scale. Pilot plants and demonstrations can show that the processes work. However, integrating the components at full scale including tying the process to a real full scale power plant creates risk that cannot be anticipated or encountered at small scale or even in advanced modeling (since modeling effectively only knows what you have told it). Some examples would be: how does the CCS process react when the power plant suddenly comes down on load; how, when the CCS process depends on steam from the power plant, does the process react to lower steam availability and how quickly can the process adjust; what are the effects on the subsequent processes like compression and transportation of such events; what is the impact on the process when the upstream air pollution control equipment malfunctions.

3 .Setting EPA's proposed BSER determination aside, is there technological reason to assert that capturing and storing carbon from a coal fired power plant has been "adequately demonstrated" or is significantly different from the potential of capturing and storing carbon from a natural gas fired power plant? What are the estimated costs per megawatt generated?

Answer: As stated above, we do not believe that CCS on coal plants has been adequately demonstrated at full scale. There have been or are four small demonstrations of about 40 MW and many smaller plants. This is not adequate demonstration .As far as the technology being used on natural gas plants, the work at Mongstadt by TCM and Alstom has shown the same fundamental technology works on natural gas at similar scale. Alstom has published projected cost data based on a large number of assumptions and relying on these small scale demonstrations and concluded that given a reasonable variation range the costs for both fuels with CCS can be comparable on the cost of electricity.

4. EPA claims that the NSPS rule is technology forcing. In other words, by mandating technology, companies will find a way to make it work and use it. First, this seems to contradict the notion that the technology has been adequately demonstrated.

a. But setting that aside, what happens if you push CCS too hard and prematurely require its use? Does this rule really provide an incentive for CCS?

b. In your testimony, you say the Clean Air Act (CAA) is a "market driver" not a "technology driver". Can you explain the distinction you make- and the implications?

Answer: In the case of this regulation, by pushing CCS on coal alone, it means that the industry (as noted by EPA) will simply build gas plants. It should be noted that all effort behind CCS development has been supported by the coal interests. Even DOE's program only envisioned CCS on coal. Therefore if you stop building coal it is logical that the effort to develop CCS, funded by coal interests, will stop and the technology will not be developed as there will be no market for the technology in the foreseeable future. As proposed this regulation does incentivize CCS development.

The distinction I made between "market driver" and technology driver under the Clean Air Act is based on the history of technology being ready when EPA called for it not technology being invented when EPA called for it (as with carbon capture). The first sulfur commercial scrubbers were built in 1942 in London well ahead of the CAA. The first SCRs were developed in Japan in the 1980's well ahead of the NOxSIP Call in 1999. Mercury technology had been developed in the 1980s for Waste to Energy Plants at full scale well ahead of the mercury regulation in 2010. Particulate Control is similar. In all cases the technologies were decades ahead of CAA. Therefore I call the CAA a market driver. Only for Carbon on power plants was the technology never developed ahead of the regulation.

5. Mr. Hawkins testified that applying CCS will not raise the power prices because it averages over all plants. Do you agree with this assessment?

Answer: No. Generally in the US, plants dispatch based on their cost versus the price in the market. Therefore, plants with CCS will not dispatch until the price rises to their cost level or they may not dispatch at all. If they don't dispatch, obviously they won't raise the price. The first couple of plants will likely not influence the average price of electricity but once CCS is widely deployed and many plants have the higher cost that goes with the added cost of CCS, the price of electricity will rise sharply. DOE has indicated as much as 80%.

6. Mr. Hawkins said that the application of CCS will reduce carbon by comparing it to a new coal fired power plant without carbon capture and storage technologies. Do you agree that the rule would reduce carbon emissions or would you analyze reductions in a different way? Does EPA follow Mr. Hawkins' methodology?

Answer: Even EPA concedes that this rule will not reduce carbon since it only applies to new plants. This rule will simply slow the rate of accumulation because the new plants will be gas and produce carbon at a lesser rate. All agree no new coal will be built. In Mr. Hawkins analogy, you cannot claim reductions by referring to a base line of a new plant without CCS since that cannot be built.

7. What is the difference between the processes for IGCC and industrial gas separation (selexol and rectisol)? Are these the same as what would be required for most fossil power generation? Are these processes EPA and Mr. Hawkins cite, applicable to atmospheric flue gases? What are the respective technology limits and what has been demonstrated at scale today?

Answer: Selexol and Rectisol are processes designed to separate carbon at high pressure. It is what drives the reactions. Unfortunately, all power plants except IGCC operate at atmospheric pressure where these processes do not work. In simple R&D terms, more than a several dozen companies and DOE would not have pursued alternatives, spending billions of dollars, if these old known technologies worked on coal and gas power plants. Virtually no other technology has currently been demonstrated on a commercial scale power plant. While there are many small demos and pilots, currently there have only been 4 demos as large as 40 MW- clearly not full-scale. While many point to selexol and rectisol technologies on conventional gas separation, even DOE believed they needed to fund R&D efforts as the treated gas steams have different compositions and different impurities than conventionally treated streams.

8. EPA sites several examples of CCS technologies as being used for decades.

a. Would you discuss the details of any of the projects EPA has cited? What is the current status of each? Are these projects representative of full-scale power generation? Have they faced any challenges- either technical, financial, legal or otherwise?

b. Are polygeneration, industrial gasification or other similar projects that plan to integrate CCS substantially similar to CCS for Fossil fuel fired power plants?

c. Are there any failed proposals or abandoned projects that EPA has failed to cite?

Answer: The following were cited:

-Southern Kemper/Radcliffe: IGCC with selexol- full scale- start-up projected late 2014 or early 2015

-Sask Power Boundary Dam- 100Mw- not full scale - projected to start up in summer of 2014

-NRG Parrish- has not started construction

-Summit East Texas Clean Energy Project- has not started construction- polygen

-HECA - polygen- has not started construction

-AEP Mountaineer- 30 MW demo successful but shut down- commercial 250 MW project ended for lack of rate recovery or financing

-Southern Barry- 30 Mw demo- running

- AES Warrior Run and Shady Point- 12 MW and 7 MW respectively and extremely high power consumption (35% parasitic load) making these examples clearly not under consideration for commercial application.

All the polygeneration facilities are IGCC and use either selexol or rectisol . Each of these facilities are designed to produce chemicals as a prime source of revenue should they ever be built. So these would not be either technically or economically like a conventional power plants. Both of these facilities have had to seek financing outside the US but neither has closed financially.

9. I understand that there are some industries, such as the chemical industry and the cement industry that can utilize CO2 in their production processes. I also understand that it can be used as a feed stock for algae and other alternative fuels.

It has been suggested using captured CO2 in these types of applications may provide additional means of compliance for power plants. How would you characterize the feasibility of using these technologies to comply with EPA's NSPS proposal?

Answer: Many of these technologies offer promise, particularly low carbon fuels. However, virtually all of these offer niche markets compared to size of full scale deployment of CCS. It is hoped that as these processes are developed it can drive the R&D necessary to bring full scale carbon capture to the market at a cost reduction over current projection. It is worth noting that the cement industry in particular is a major CO2 generator and is looking to achieve reductions- thus not requiring more CO2. The final point is that many small scale R&D efforts are underway but none nearly at the scale require for the power plant industry.

CITY UTILITIES

Bringing Power Home.℠

April 15, 2014

The Honorable David Schweikert
Chairman
Subcommittee on Environment
Science Committee
2321 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Cynthia Lummis
Chairman
Subcommittee on Energy
Science Committee
2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairmen Schweikert and Lummis:

Thank you for the opportunity to testify last month at the joint Subcommittees on Environment and Energy hearing entitled the *Science of Capture and Storage: Understanding EPA's Carbon Rules*. It was a great honor to speak to the Members of the two subcommittees on City Utilities of Springfield's (CU) experiences with the Missouri Shallow Carbon Sequestration Demonstration project and the American Public Power Association's (APPA) concerns with the Environmental Protection Agency's (EPA) conclusion that carbon capture and sequestration (CCS) is the best system of emissions reduction (BSER) adequately demonstrated to reduce carbon dioxide (CO_2) emissions from new fossil fuel-fired power plants.

Attached are my responses to your questions for the record. If you have any questions about my responses, please let me know.

Sincerely,

Scott Miller
General Manager

Attachment

Responses to Science Committee Questions – Follow-up to CCS Hearing

Question 1 – Prior to public release of the NSPS rule, the Office of Management and Budget circulated it to other Federal agencies to provide feedback to EPA. That feedback resulted in 35 pages of comments that were published with the rule—many of which were extremely critical. I want to zero in on one particular set of comments made by another agency. They said:

> EPA's proposal will have significant disparate geographic impacts. Geologic features appropriate for EOR or geologic sequestration are not evenly distributed throughout the country…
> …the D.C. Circuit has said that sec. 111 standards "must not give a competitive advantage to one State over another in attracting industry."

Question 1(a) – Would you agree that the ability to do either EOR or geologic sequestration are very site specific, and many states and regions will simply not have EOR or sequestration options?

City Utilities agrees that the ability to do either enhanced oil recovery (EOR) or geologic sequestration are very site specific, and many states and regions will simply not have EOR or sequestration options. Our own experience as a participant in the Missouri Shallow Carbon Sequestration Demonstration Project indicates that our local region (Southwestern Missouri) would be unsuitable for carbon sequestration, even though other parts of Missouri may prove suitable for this purpose.

A requirement that all new coal and natural gas fired power plants use CCS would certainly advantage a few states and disadvantage many others. Most states do not have the appropriate geology for the long-term injection and sequestration of CO_2 (i.e., storage for between 500-1,000 years). Nor do they have the option to employ EOR, which is conditioned by the availability of working petroleum operations. Most states also do not have laws that allow for the injection of a commodity or waste product into the subsurface. In fact, in most states, the only person that can decide what may go underground is the surface land owner. Thus, any injection of CO_2 underground that migrates into the subsurface of another landowner would be an illegal trespass. The lack of geology allowing for long-term storage of CO_2 and inability to contain that CO_2 within the subsurface of the utility's property significantly limit the ability of many states to sequester CO_2 underground or use it for EOR, which involves the recycling and movement of the CO_2 from location to location and does not constitute long-term storage.

Question 1(b) – Do you think this rule will put specific states and regions at a competitive disadvantage?

The rule would put specific states and regions at a competitive disadvantage if utilities operating in them are incapable of sequestering the CO_2 underground or using it for EOR. Utilities in these areas would either be prohibited from constructing coal-fired units altogether, thereby having to rely on more expensive forms of generation, or would have to construct – or in the case of City Utilities, pay someone else to construct and operate – long-distance pipelines to carry captured CO_2. In either case, residential and industrial customers in the affected region would experience significantly higher electric costs than similar utilities situated with convenient access to sequestration fields.

In addition, utilities operating in non-oil and gas states would have to build pipelines to transport CO_2 captured from their plants to states with EOR or geologic formations more suitable for long-term sequestration of CO_2.[1] While other states might have pockets of geologic formations with natural gas or oil, the limitations of the geology might preclude the construction of power plants with CCS at those

[1] The traditional oil and gas states are Texas, Oklahoma, New Mexico, Colorado, Louisiana, Wyoming, Pennsylvania, and Alaska.

locations. Thus, use of captured CO_2 from power plants for EOR will be limited to those states with significant EOR.

Electric utilities want their generation located near load for a variety of reasons, including electric reliability. If they are precluded from building new coal or natural gas-fired power plants because their local geology precludes the sequestration of CO_2, they will have to invest in pipeline infrastructure to transport the CO_2 to distant EOR locations or formations that can store it long term. Such infrastructure will require utilities to spend money that will lead to increased electric rates. Utilities in EOR areas would not bear the same costs.

Question 1(c) – Do you believe CO_2 pipelines can solve this problem?

Long-distance CO_2 pipelines would not totally solve the problem of competitive disadvantage. Although a pipeline network could provide access to remote storage locations, that access would come at the expense of building and operating the pipeline. Such a pipeline would have to be newly constructed of special materials to withstand the inherent properties of compressed CO_2.

Existing natural gas pipelines cannot be used to transport CO_2. Specialty pipelines are required to transport CO_2. There are approximately 3,900 miles of CO_2 pipelines in the U.S. today and more than half are privately held (i.e., not a common carrier pipeline). The owners of those pipelines are under no obligation to take and transport CO_2 from the power sector.

Neither the Department of Energy (DOE) nor EPA have done a pipeline assessment map that shows the available capacity on existing CO_2 pipelines, which only operate in limited number of states. Many CO_2 pipelines appear to be at full capacity for movement between oil and gas recovery locations in Texas, Wyoming, Oklahoma, New Mexico, Utah, and Colorado. Thus, they likely have little ability to move utility-captured CO_2. In addition, there are concerns in the EOR business with cross contamination from CO_2 from coal plants, which contain sulfur salts and other substances. The presence of those substances can cause regulatory uncertainty for CO_2 injections into Class II or Class VI wells under the Resource Conservation and Recovery Act (RCRA). RCRA provides for certain regulatory treatment of CO_2 and other hydrocarbon processing waste products or substances in the oil and gas sector that are not applicable to CO_2 from the power sector.

Question 2 – In your testimony, you discussed City Utilities' involvement with the Missouri Carbon Sequestration Project.

Question 2(a) – What is the significance of storing CO_2 in a gas phase as opposed to a supercritical fluid?

The most critical difference between storing CO_2 in a gas phase as opposed to a supercritical phase is the amount of volume required. A given mass or weight of any substance will occupy much more volume in the gaseous state than in the liquid state (for example, a given amount of water expands to 1,700 times its original volume when it becomes a gas at the normal boiling point and atmospheric pressure). Supercritical CO_2 has somewhat intermediate properties in that it has a density closer to a liquid, but it is still compressible like a gas.

Question 2(b) – Given this experience, are you confident that City Utilities would be able to build new generation in compliance with the NSPS proposal? Has EPA limited the public's opinion with this rule?

We have no confidence that City Utilities would be able at any time in the future to build a coal-fired power plant under EPA's proposed NSPS for new power plants. While City Utilities has no plans to build such a plant, the rule would in all likelihood, remove such an option from future consideration.

Question 2(c) – With natural gas as an affordable alternative, why would City Utilities want to build coal power? From a public power perspective, does limiting options raise any reliability concerns?

If natural gas were proven to be an affordable and reliable alternative, City Utilities might well decide to build a natural gas-fired power plant instead of coal generation in the future. In fact, City Utilities recently built a new 300 megawatt unit and considered both coal and gas before ultimately deciding to go with coal. Our concerns with gas during the planning process were related to the price fluctuations and seasonal supply instability of natural gas. Those concerns were borne out in the recently concluded winter of 2013-14, when natural gas prices spiked as high as $31 per million Btu (compared to coal prices of around $2.50) and major disruptions in the natural gas supply system led to widespread shortages and use curtailments in many parts of the country.

At a more fundamental level, City Utilities' managers need the flexibility to consider and choose the best fuel options for our customers and our system. While we might, as indicated, elect to build a new unit using gas instead of coal, our planning and analysis should be based on sound principles of economics, reliability, and responsibility, rather than artificial government mandates.

Question 3 – If EPA finalizes this rule as proposed:

Question 3(a) –What are the implications for your customers – as City Utilities retires older coal plants and adds new sources of power?

While City Utilities has no plans to retire any coal-fired units or other generating assets at present, we must recognize that our existing fleet will have to be replaced at some point in the future. If we are foreclosed from replacing existing coal units with similar technology in the future, our rates and reliability will likely be negatively affected, particularly during the winter months, when U.S. natural gas infrastructure is strained to its limits, as we recently witnessed this winter. From an economic perspective, total reliance on natural gas for electric generation would force our customers to pay twice for seasonal gas price spikes. Our natural gas customers already see this effect in the winter when residential and commercial heating demand causes gas prices to escalate and utility bills to increase. Our electric customers would also see similar price increases if we had to generate primarily from natural gas.

We worry that an over-reliance on natural gas for electric generation could result in periodic brownouts or blackouts due to the inability of the gas delivery system to supply our fuel demands. We have seen this happen on numerous occasions in the past and as recently as March of this year. These can occur due to a lack of pipeline capacity or to catastrophic disruptions, such as pipeline equipment failure, tear-outs, fires, etc. Prior to the Fuel Use Act of 1978, City Utilities was reliant on natural gas as a generating fuel and had to deal with such disruptions on a normal basis. Fortunately, we were able in those times to continue generation because we were equipped with coal backup capabilities. Another major difference between 1978 and today is that we now have 263 customers who have registered life support systems in their homes. These customers rely on electric supply as a matter of life and death.

Question 3(b) – Is City Utilities facing deadlines for other EPA rules that may compound reliability concerns or other impacts?

City Utilities is facing an April 2015 deadline to install air pollution control equipment under EPA's Mercury and Air Toxics (MATS) rule. Installation on three of our six older coal-fired units is expected to take longer than this and we have been granted a one-year compliance extension by the State of Missouri. At this point, we do not believe we will need to apply for a second extension to ensure system reliability. However, the three remaining smaller units are being relegated to standby duty as a result of this rule and the Industrial Boiler MACT rule, and will revert to natural gas as a primary fuel. This move engenders all of the reliability risks delineated above.

We also face a host of additional regulatory actions directed by EPA at our coal-fired plants, but at this point cannot estimate their impact on unit or system reliability. Future and proposed rules that will impact our coal plants include, Clean Water Act Section 316(b) cooling water intake structures, effluent limitations guidelines, and coal combustion residuals. We are also impacted by EPA's regional haze rules and would be by its Cross State Air Pollution Rule, but for the fact that the D.C. Circuit Court of Appeals overturned it because the agency exceeded its authority under the Clean Air Act. We have no idea what EPA will propose in its place. In addition, all of these rules will likely face legal challenges that will add to our uncertainty. The inability to plan for the impact and timing of these rules may have as much bearing on system reliability as the ultimate rules will.

Question 3(c) – If you are unable to add new coal or natural gas capacity, what might this mean for your customer's electric bills?

Currently, coal and natural gas units account for approximately 70% of the nation's generation. If we were limited from considering these U.S.-based fuels as options, nuclear is a tough option for us due to scale. We would be left with limited options such as buying power on the market through Southwest Power Pool, a move that removes supply from our community's control. This will change our cost and reliability profiles for the worse. Ultimately we believe it would negatively impact our community from an economic development perspective.

Question 4 – In your testimony, you stated that EPA's "failure to examine the non-air environmental consequences of CCS is a blatant violation of the letter and spirit of the Clean Air Act and the public's trust." That is a serious allegation. What are some examples of non-air environmental consequences the agency failed to consider?

There are many cross-media issues EPA failed to examine, including: (1) hazardous substance and superfund implications for environmental releases; (2) potential surface water contamination; (3) potential impacts to navigable waters and surface water flow; (4) Endangered Species Act implications; (5) land planning; (6) seismic activity; (7) natural resource depletion; and (8) resolution of underground access and trespass concerns.

For example, on the issue of potential Super fund liability, EPA has ignored the fact that CO_2 is an acid gas. Injecting it into the ground could change the pH of the soil or water receiving it. Such a change to pH change could trigger a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) remediation action. Other industries have been held liable for comparable changes to soil pH. For example, the dry cleaning industry faced CERCLA lawsuits for the release of dry cleaning solvents through sewer systems and where, it was alleged, that the solvents changed the pH.

There is no evidence in the proposed NSPS rule or accompanying Technical Supporting Documents that the Office of Air and Radiation consulted with the Office of Solid Waste and Emergency Response on the Superfund implications of sequestering CO_2. Nor has the agency addressed whether utilities injecting CO_2 would be given indemnification from liability for any potential environmental harm under

Superfund. EPA has been briefed on this issue by APPA and others many times between 2009 and 2014. The agency cannot assert it is unaware of the issue.

Another issue EPA has failed to look at is the creation of sulfur salts from the capture of CO_2 from power plants that generate with integrated gasification combined cycle (IGCC) technology where coal is gasified. There is nothing in the record that shows that the Office of Air and Radiation has met with the Office of Waste and Emergency Response to discuss the disposition of such salts. While there is a market for sulfur salts today, it is limited. It is very unclear whether it would be able to handle the large number of salts future IGCC plants with CCS would create. Thus, these surplus sulfur salts would need to be treated as waste and placed in either a solid waste landfill or hazardous waste landfill if the sulfur salts did not pass the toxicity characteristic leaching procedure (TCLP).

EPA has also not consulted with the U.S. Fish and Wildlife Service (FWS) regarding the potential impact of sequestered CO_2 on endangered and threatened species. When asked by the House Science Committee and Senate Environment and Public Works Committee at hearings on March 12 and April 8, 2014, respectively, Acting Assistant Administrator Janet McCabe stated EPA has not spoken with FWS about these potential impacts. She gave no reason for EPA's failure to do so.

Another issue EPA has failed to look at is the creation of sulfur salts from the capture of CO_2 from power plants that generate with integrated gasification combined cycle (IGCC) technology where coal is gasified. There is nothing in the record that shows that the Office of Air and Radiation has met with the Office of Waste and Emergency Response to discuss the disposition of such salts. While there is a market for sulfur salts today, it is limited. It is very unclear whether it would be able to handle the large number of salts future IGCC plants with CCS would create. Thus, these surplus sulfur salts would need to be treated as waste and placed in a solid waste landfill (or hazardous waste landfill only if the sulfur salts did not pass the toxicity characteristic leaching procedure). (We have no reason to believe that sulfur salts would create this new regulatory issue but we are simply identifying it as one of the many that EPA did not look at).

As my written testimony states, on December 4 and 5, 2013, EPA's SAB raised concerns about the scientific and technological bases EPA relied upon when proposing to mandate CCS for NSPS for new coal-fired power plants. Specifically, the SAB expressed concern with the peer review process of the DOE studies that were relied upon in the proposed rule, how the agency came up with its emissions limits for new coal- and natural gas-fired power plants, and the fact that the proposed rule does not address the sequestration side of CCS. EPA responded to those concerns by asserting that regulatory mechanisms for addressing sequestration were outside the scope of Clean Air Act and thus do not need to be addressed in the NSPS for new fossil fuel-fired power plants. Agency staff stated that only the capture side of CCS needs to be addressed.

The SAB, in a letter to EPA Administrator Gina McCarthy, dated January 29, 2014, stated it "defers to EPA's legal view…that the portion of the rulemaking addressing coal-fired power plants focuses on carbon capture" because that is all that is within the scope of the Clean Air Act. The letter notes, however, that "carbon capture is a complex process, particularly at the scale required under this rulemaking, which may have multi-media consequences." The board expressed its strong view that "a regulatory framework for commercial-scale carbon sequestration that ensures the protection of human health and the environment is linked in important systematic ways to this rulemaking." It encouraged EPA to have the National Research Council review the research and information on sequestration conducted by it, DOE, and other sources.

While SAB deferred to EPA's legal interpretation of its authority to look at cross-media issues rising from sequestration of CO_2, it is significant that the SAB raised these concerns. It is clear that several

members of the SAB agree with APPA that these issues need to be resolved before CCS is declared BSER.[2]

Question 5 – Issues like long-term legal liability, mineral rights, pore space ownership, cross-state CO_2 plume migration, transport rights of way, and permitting authorities all remain largely unanswered. These risks, unknowns, and uncertainties with saline storage could pose serious problems. What steps has EPA taken to resolve these issues?

To APPA's knowledge, EPA has made no attempt to address legal liability, differences in state mineral rights laws (or their lack of existence), pore-space concerns, and cross-state CO_2 plume migration issues. APPA raised these issues with EPA more than a dozen times in person and in writing in several EPA dockets, including those on the Underground Injection Control (UIC) program, NSPS, and climate change policy in general. Further, ten witnesses spoke before the EPA Science Advisory Board (SAB) on the enormous obstacles to the adequate demonstration of this technology in January 2014. Thus far, EPA has ignored their concerns on these issues. In addition, on February 6, 2014, a representative from the American Petroleum Institute (API) spoke to EPA about the dramatic differences between EOR/enhanced gas recovery (EGR) in the oil and gas sector and the presumption of the adequate demonstration of CCS for the power sector. He offered to provide EPA with a detailed briefing on the significant differences between long-term sequestration of CO_2 and EOR.

The committee should look to the American Water Works Association (AWWA) on the possible or potential uses of saline aquifers. AWWA represents both public and private entities that provide drinking water to the public. Many APPA members provide both electric and drinking water services as municipal agencies and are also members of AWWA. In the summer of 2009, APPA and AWWA briefed EPA's Water Office on shared concerns regarding the presumption that CO_2 could be stored permanently underground for the power sector. APPA and AWWA offered to brief EPA's Office of Air and Radiation. Unfortunately, the offer was rejected by EPA staff.

[2] Per the request of the SAB, APPA sent a letter to it on December 9, 2014, outlining our concerns with the many obstacles to commercial demonstration of sequestration. The letter can be viewed at http://www.publicpower.org/files/PDFs/APPA%20Letter%20to%20EPA%20on%20SAB%20--%20FINAL%20--%2012-9-2013.pdf.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Subcommittee on Environment
Subcommittee on Energy

Responses to Subcommittee Questions in Letter dated April 1, 2014
Relative to March 12, 2014 Hearing:

Science of Capture and Storage: Understanding EPA's Carbon Rules

Robert C. Trautz
Electric Power Research Institute

1. Can you discuss the operational differences between CO_2-based EOR operations and CO_2 storage operations that are not EOR-based projects? What are the technical challenges associated with geologic sequestration at the scale required under the NSPS proposal?

There are a number of significant operational differences between CO_2 EOR and CO_2 storage projects including 1) CO_2 purity and quality; 2) objectives and economics; 3) supply and demand; 4) legal and regulatory; 5) assurance of well integrity; 6) long-term CO_2 monitoring requirements; and 7) industry experience. A detailed analysis of these differences is described in the "Final Report by the Carbon Sequestration Leadership Forum Task Force on Technical Challenges in the Conversion of CO_2-EOR Projects to CO_2 Storage Projects" dated September 2013.[1] The most significant difference stems from the fact that the two types of projects have different objectives. EOR operators must purchase CO_2 and use it effectively to minimize costs and maximize profits from oil production. Therefore, EOR operators use CO_2 sparingly and recycle produced CO_2 whenever possible because it is a valuable commodity and large expense. EOR operators recognize that incidental storage of the CO_2 in the formation is unavoidable and an expense that must be factored into the initial financial investment decision. CO_2 storage operators on the other hand focus on storage capacity, long-term sustainable CO_2 injection and whether a low permeability caprock is present to keep the buoyant CO_2 in the storage formation. CO_2 storage operators must implement an extensive monitoring program to ensure that the CO_2 remains in the storage reservoir. In contrast, EOR operators perform limited monitoring to optimize flood performance and maximize oil production. Both types of projects must develop injection strategies, tailor injection operations and manage reservoir pressures to meet site-specific project objectives and investment needs.

The biggest challenge that CO_2 project developers face is the scarcity of available technical information on saline formations. Technology is available to collect the information, but given

[1] Bachu, S., P.R. da Motta Pires, M. Li, F. Guzmán, L. Ingolf Eide, A. Aleidan, M. Ackiewicz, S. Melzer, Technical Challenges in the Conversion of CO_2-EOR Projects to CO_2 Storage Projects, Report Prepared for the Carbon Sequestration Leadership Forum (CSLF) Technical Group by the CSLF Task Force on Technical Challenges in the Transition from CO2-EOR to CCS, September 2013.

the large volumes involved with full scale CO_2 storage and scarcity of information, several attempts may be needed to find specific injection sites with suitable storage capacity and formation injectivity. Failed attempts to find suitable storage can result in higher asset exploration costs on the order of tens of millions of dollars for onshore and $50 million or more for offshore sites prior to injection.[2] Exploratory costs are especially high for heterogeneous rock formations that require more characterization.[3] These costs do not include the normal asset appraisal and development costs needed once exploration activities identify potential storage sites. The Gorgon Project, a natural gas separation and CO_2 injection project in northwestern Australia, has spent in excess of AU$150 million on site-appraisal activities for its CO_2 injection project prior to the financial investment decision. Gorgon is located within a known hydrocarbon province with good well control, but environmental costs associated with locating the project in a nature reserve have also contributed to increased costs. The onshore ZeroGen project in Australia represents the opposite end of the risk spectrum where AU$90 million was spent on site characterization activities for several years on a preferred saline target before the project was abandoned because the formation was found to be uneconomical for large scale storage.[4] From a technical standpoint, CO_2 storage operators will be faced with injecting large volumes of CO_2 into saline reservoirs over periods spanning several decades. Uncertainty associated with sustained injection of large volumes of CO_2 and associated pressure buildup in the storage reservoir that can lead to potential problems is borne out by existing global experiences documented in my written testimony for the Snøhvit and In Salah natural gas separation and CO_2 storage projects.

2. If we overcome the engineering challenges associated with storage, other practical problems persist. Issues such as long-term liability, mineral rights, pore space ownership, cross-state CO_2 plume migration, transport rights of way, and permitting authorities can dramatically overshadowed the technical challenges we hope to master with more projects.

Currently, the risks, unknowns, and uncertainties associated with CO_2 storage appear to be showstoppers.

a. What will diffuse the legal and practical complexities of CO_2 transport and Storage?

b. Is EPA moving in the right direction to solve these problems?

EPRI is aware of the legal issues that you have raised, which have been identified and analyzed by others in the CO_2 storage literature.[5, 6, 7, 8] As a technology and research & development

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[2] Global CCS Institute, 2011. The global status of CCS: 2010, Canberra.
[3] Zero Emissions Platform (ZEP), 2011. The Costs of CO_2 Storage: Post-demonstration CCS in the EU, prepared jointly by the European Technology Platform for Zero Emission Fossil Fuel Power Plants and the IEA-GHG programs.
[4] Garnett, A., 2010. "The ZeroGen Flagships Project Look back and Update," Presentation National CCS Week, Melbourne, Australia.
[5] Jacobs, W.B., L. Cohen, L. Kostakidis-Lianos, S. Rundell. "Proposed Roadmap For Overcoming Legal and Financial Obstacles to Carbon Capture and Sequestration" Discussion paper 2009-04, Cambridge, Mass.: Belfer Center for Science and International Affairs, March 2009.
[6] de Figueiredo, M.A., 2007. The Liability of Carbon Dioxide Storage, PhD dissertation, Massachusetts Institute of Technology

organization and a 503(c)(3) corporation, EPRI does not comment on legal feasibility or the appropriateness of direction taken by government agencies with respect to legal or policy related issues.

3. At a recent hearing Acting Assistant Secretary for Fossil Energy (FE), Chris Smith, stated that "FE is funding, in partnership with industry, eight major demonstration projects that will help address the first-of-a-kind technology risks that come with deploying innovative CCS technologies. He further noted that "FE is also focused on carbon storage, developing technologies with industry to ensure the safe and permanent storage of captured CO_2 in different geologic formations... These large volume tests and related applied science will provide the field experience to develop and validate technologies that can predict storage capacity, validate storage permanence, and develop best practices."

Is DOE really saying that these large volume tests have not been completed yet?

EPRI's experience is limited to direct involvement in the DOE Phase II and III Regional Carbon Sequestration Partnership (RCSP) program and American Electric Power's Mountaineer project under the DOE Clean Coal Power Initiative (CCPI). The Phase II projects consisted of injecting a few hundred to a few thousand tons or less of manufactured CO_2 shipped by transporter to each site. These small scale Phase II CO_2 storage projects have been completed. The CO_2 storage projects within the Phase III RCSP and CCPI programs are at various stages of completion but all are still ongoing. Injection of approximately 37,000 tons of CO_2 at the Mountaineer power station ended in May 2011, but post injection monitoring and site care continue as required by the State permitting authority. The individual RCSP projects aren't scheduled to be completed until 2017 with the exception of the SECARB Early Test near Natchez Mississippi. This includes the Plant Barry carbon capture and injection project where 100,616 metric tons of CO_2 has been injected to date. The SECARB Early Test is part of a 1.5 million ton per year commercial CO_2-enhanced oil recovery (EOR) project operated by Denbury Onshore, LLC that uses CO_2 derived from a natural source. This DOE research project is scheduled to be completed in 2015, but the commercial EOR operation will continue.

4. EPA's cost assessment of CCS is based, in part, on the assumption that power plants can sell CO_2 to EOR operators. In order to comply with the standard, however, storage operators must report under Subpart RR of EPA's greenhouse gas reporting rules.

a. Can you describe the effect this requirement will have on EOR operators? How is this different than Subpart UU requirements that EOR operators currently report under?

As stated in my testimony, the potential use of depleted oil and gas reservoirs for CO_2 storage could be adversely affected by potential regulatory requirements associated with CO_2 storage. Preliminary feedback from oil producers suggests that a requirement for EOR operators to

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[7] Fish, J. R., S. Rives, E. L. Martin, California Carbon Capture and Storage Review Panel, Technical Advisory Committee Report: Approaches to Pore Space Rights, August 10, 2010.

[8] IOGCC, 2007. Storage of Carbon Dioxide in Geologic Structures: A Legal and Regulatory Guide for States and Provinces, The Interstate Oil and Gas Compact Commission (IOGCC) Task Force on Carbon Capture and Geologic Storage, supported by the Department of Energy under award number DEFC26-05NT42591, September 25, 2007.

monitor a storage facility and certify that the CO_2 is stored under Subpart RR of the EPA's mandatory greenhouse gas reporting program, could be a risk that companies may not be willing to accept. Thus, such requirements may have the consequence of discouraging the use of depleted oil and gas reservoirs.

EPA's Mandatory Greenhouse Gas Reporting rules under Subpart RR and UU require that the operator monitor the volume and quality of CO_2 being injected. In addition, the rule requires facilities conducting geologic sequestration of CO_2 under Subpart RR develop and implement an EPA-approved site-specific monitoring, reporting and verification (MRV) plan, and to report the amount of CO_2 sequestered using a mass balance approach. EPA estimates that the annual cost of reporting for each facility under Subpart RR is $320,000 compared to $4,000 under Subpart UU.[9]

b. NRDC, among others, has advocated that EOR operators utilizing CO_2 from power plants should be forced to move from Class II to Class VI wells. In fact, formal rulemaking comments made by Mr. Hawkins and NRDC were submitted for the record during our hearing. Some seem to suggest that it is simple to move from operating under an EPA Class II permit to a Class VI permit. Would such a transition be relatively simple?

EPRI's permitting experience to date is limited to preparing documentation for Class V well permit applications for our existing DOE funded projects. We do not have direct experience related to permitting of Class II or Class VI wells, or the transition from Class II to VI wells. With that said, a review of the EPA's draft guidance document on transitioning wells from Class II to VI operations indicates that the well owner or operator must comply with all Class VI requirements. Only certain components of the Class II well construction may be grandfathered into the Class VI program at the discretion of the EPA Program Director. The Class VI well standards are much more comprehensive and specific compared to the Class II requirements.

c. How difficult is it to obtain a Class VI permit? How many currently exist?

As noted earlier, EPRI does not have any direct Class VI permitting experience and, therefore, cannot comment on the difficulty of obtaining such a permit. No "final" Class VI permits have been issued to date, however, EPA recently issued four "draft" Class VI well permits for the FutureGen Alliance project on March 31, 2014. The FutureGen Alliance or any other person may comment on the draft permits. The public comment period will be open for 45 days. The EPA received the FutureGen permit applications on March 15, 2013.

5. During our hearing you were asked if a pipeline from the Northeast to the Midwest or Texas for sequestration of EOR was feasible. While you responded that such an undertaking could be possible from an engineering standpoint, my question relates to real-world feasibility.

[9] United States Environmental Protection Agency, Fact Sheet for Geologic Sequestration and Injection of Carbon Dioxide: Subparts RR and UU, November 2010.

a. As a rule of thumb, pipelines costs $200,000 per mile per inch of diameter. So for example, a 12-inch pipeline would cost roughly $2.4 million per mile. So a two thousand mile pipeline of modest size would cost roughly $5 billion to construct.

Is this a cost EPA considers in the proposed rule? Is this a cost you would consider feasible?

My response to the question during the hearing was intended to highlight that CO_2 pipeline construction is feasible from a technical standpoint. We have the technology needed to construct and maintain pipelines of substantial length as demonstrated by the 278,000 miles of onshore and offshore natural gas transmission lines in the United States alone.[10] Approximately 3,500 miles of CO_2 pipelines have also been constructed for EOR purposes. The pipeline costs that you provided of $200,000 per inch-mile exceeds estimates published in the open literature for the U.S.by a factor of 2–4, which range from $50,000-$110,000 per inch-mile, including labor, materials and right-of-way costs, which vary by location.[11] Many factors must be taken into consideration when determining the economic viability of a CO_2 transportation and storage project, including the distance to the closest and highest quality geologic storage location (i.e., sink) and backup storage locations. For areas of the country where CO_2 storage is a challenge, a project developer will need to weigh the cost/benefit of storing CO_2 in the best available sink for compliance versus building a longer pipeline to an EOR project where revenue may be realized from the sale of CO_2.

b. Such a pipeline would also require a significant right of way along its two thousand mile path. How long would that take? Is there a federal authority that currently regulates interstate CO_2 pipelines? Does such a body have imminent domain authority over private land owners?

EPRI's pipeline experience is limited to the relatively short 12.2 mile, one off, fit-for-purpose pipeline constructed by Denbury Gulf Coast Pipelines LLC for our SECARB Citronelle research project in Alabama. Once the permits and right-of-ways were obtained, pipeline construction moved quickly to completion within 2−3 months. The following authorities were consulted or required permits during the design and construction of the pipeline:[12]

- National Environmental Policy Act (NEPA) – U. S. Department of Energy
- National Pollution Discharge Elimination System (NPDES) storm water registration – Alabama Department of Environmental Management
- Alabama Historical Commission (AHC) – cultural resource identification and disposition
- State Historic Preservation Office (SHPO) – cultural resource identification and disposition
- U.S. Fish and Wildlife Service (FWS) – consulted for threatened and endangered species

[10] American Petroleum Institute (API) and the Association of Oil Pipe Lines (AOPL), 2007. Pipeline 101, http://www.pipeline101.com/Introduction/index.html

[11] Ortiz, D. S., C. Samaras, E. Molina-Perez, The Industrial Base for Carbon Dioxide Storage: Status and Prospects, Rand Corporation, 90 pp., Mar 15, 2013

[12] Esposito, R., C. Harvick, R. Shaw, D. Mooneyhan, R. Trautz and G. Hill, 2013. "Integration of pipeline operations sourced with CO2 captured at a coal-fired power plant and injected for geologic storage: SECARB Phase III CCS Demonstration," Energy Procedia, 37, 3068–3088, doi: 10.1016/j.egypro.2013.06.193

- Alabama Department of Conservation and Natural Resources (ADCNR) – consulted for threatened and endangered species
- U.S. Army Corps of Engineers (USACE) – waterbodies and wetlands protection
- U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) – regulates the design, construction, operation, maintenance, and spill response planning for regulated pipelines

Nordhaus and Pitlick (2009) indicate there is no current Federal siting or eminent domain regulatory scheme for CO_2 pipelines.[13]

c. Newly proposed changes to the Clean Water Act (CWA) will likely impact the viability of utilizing Nation Wide Permitting authorities-thus requiring thousands of CWA 402 and 404 related permits prior to construction of such a pipeline. Given the environmental reviews required, how difficult might it be to build just one of the many pipelines that would be required for a nation-wide system of CO_2 pipelines?

I am not familiar with the proposed changes to the CWA or the permits referred to in this question; therefore, I can't offer an opinion on this subject.

6. EPA and other proponents of the GHG NSPS point to sequestration at sites in Norway, Algeria, and Canada to claim that carbon sequestration is adequately demonstrated. Yet research cited in the NSPS looks specifically at these locations and concludes that a fullscale power plant would create 2-4 times more CO_2/year than was injected in these sites and that "there is truth to the often heard assertion that CCS has never been demonstrated at the scale of a large commercial power plant."

a. Would you say that geologic sequestration at the scale that would be required to comply with the NSPS has been "adequately demonstrated"?

As noted in my written testimony, there are currently no full-scale, carbon capture and CO_2 storage projects in the world that are fully integrated with a fossil-fuel fired power station. EPRI's experience has been that full-scale operating experience is essential to assuring that a technology is fully viable at necessary levels of performance and reliability.

b. Recently, Assistant Secretary for Fossil Energy, Julio Friedman, explained that we would need hundreds of full scale power plants capturing and storing carbon to make a meaningful impact on atmospheric CO_2 concentrations. Setting aside the costs of the capture portion of CCS systems, what are the largest challenges to implementing CCS at such a scale? Are there any unknowns?

Full-scale deployment of CCS on a national scale envisioned by Assistant Secretary for Fossil Energy, Julio Friedman, would result in additional technological challenges. Multiple power plants injecting CO_2 into the same storage reservoir would result in pressure interference,

[13] Nordhaus, R.R. and E. Pitlick, 2009. Carbon Dioxide Pipeline Regulation, Energy Law Journal, v 30:85, p. 85-103.

causing reservoir pressures to buildup more rapidly potentially limiting injection rates for newer plants coming on line. This could lead to competition for available storage reservoirs or require injection well fields be placed further apart to avoid pressure interference. In addition, there may also be other, non-technical unknowns, e.g. CO_2 pipeline expansion, potential procurement barriers related to high demand for material, solvents, sorbents, etc. to support such a scale.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CONGRESSIONAL AND
INTERGOVERNMENTAL RELATIONS

OCT - 3 2014

The Honorable Cynthia Lummis
Chairman
Subcommittee on Energy
Committee on Science, Space, and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Chairman Lummis:

Thank you for your April 1, 2014, letter to the Environmental Protection Agency in which you requested responses to Questions for the Record following the March 12, 2014, hearing before the Subcommittees on Energy and Environment entitled, "Science of Capture and Storage: Understanding EPA's Carbon Rules."

The responses to the questions are provided as an enclosure to this letter. If you have any further questions, please contact me, or your staff may contact Josh Lewis at lewis.josh@epa.gov or (202) 564-2095.

Sincerely,

Nichole Distefano
Deputy Associate Administrator
for Congressional Affairs

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OCT - 3 2014

OFFICE OF CONGRESSIONAL AND
INTERGOVERNMENTAL RELATIONS

The Honorable David Schweikert
Chairman
Subcommittee on Environment
Committee on Science, Space, and Technology
U.S. House of Representatives
Washington, D.C. 20515

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Sincerely,

Nichole Distefano
Deputy Associate Administrator
for Congressional Affairs

Enclosure

Questions for the Record following March 12, 2014, Hearing on the Science of Capture and Storage: Understanding EPA's Carbon Rules

The Honorable David Schweikert

1. At a hearing before the House last month, DOE Deputy Assistant Secretary for Clean Coal, Dr. Julio Friedmann, testified that requiring CCS technologies at new coal-fired plants could dramatically raise the cost of electricity for consumers.

Dr. Friedmann said that for so-called first generation technologies, there would be "something like a 70 to 80 percent increase on the wholesale price of electricity." Dr. Friedmann added that **"It** is in fact a substantial percentage increase in the cost of electricity…**"**

a. Does the EPA agree with that statement?
b. Does the NSPS proposal align with that assessment? Why or why not?
c. Is a 70 to 80 percent increase on wholesale power prices acceptable to the EPA?
d. How did EPA model the economic impacts of such an increase?

RESPONSE: The Environmental Protection Agency believes that, because the proposed new source carbon pollution standards are in line with current industry investment patterns, they would not have notable costs and are not projected to impact electricity prices or reliability. To the extent that a utility does elect to construct a new coal plant with carbon capture and sequestration (CCS) to meet the EPA's proposed standards, the standards can be met with partial CO_2 capture, which would have much lower costs than those described by Mr. Friedman which were based on an assumption of full CO2 capture. Also, the construction of new coal capacity with CCS would likely coincide with opportunities for revenue from the sale of captured carbon, for example for enhanced oil recovery, which would mitigate the CCS costs. Additionally, the costs associated with a single plant do not significantly change retail prices paid by consumers, which are derived based on the cost of generation and transmission across the power system.

The EPA's assessment of partial capture CCS, found that:

- **For a new supercritical pulverized coal (SCPC) power plant, the change in the levelized cost of electricity (LCOE) ranges from a decrease of $4/MWh (4%) with a relatively high market value for enhanced oil recovery (EOR) to an increase of $18/MWh (20%) assuming no market for EOR. It is important to note that the climate and co-benefits associated with partial CCS on SCPC ranges from $16-$22/MWh (assuming 3% Social Cost of Carbon (SCC)).**
- **For a new integrated gasification combined cycle (IGCC) facility, the change in the LCOE ranges from no difference in cost with a relatively high market value for EOR to an increase of $12/MWh (12%) assuming no market for EOR. The climate and co-benefits associated with partial CCS on IGCC is approximately $7.5/MWh (assuming 3% SCC).**

- **Note that the LCOE ranges provided above are costs of electricity from the referenced plant only – they do not reflect changes in economy-wide electricity prices which are not heavily influenced by energy prices from a single generating facility.**

2. You testified that the Agency believes that CCS systems have been "adequately demonstrated" as a technology for reducing CO_2 emissions from fossil fuel-fired power plants. However, there is no fully operational coal-fired power plant in the world currently using CCS technology.

a. Can you provide any other example of a technology required by EPA CAA section 111 regulations where the technology was **not** yet used on a commercial basis?

RESPONSE: In previous NSPS regulations, the EPA set limits based on analysis of technologies, their capability, and whether they could be transferred between similar processes. For example, in the 1990's, the EPA used selective catalytic reduction (SCR) to set NSPS for industrial boilers and utility boilers. At that time, SCR had been used on boilers in the United States and internationally. In the United States, SCR was used on just a few utility boilers, but not on industrial boilers. Some commenters suggested that SCR was not adequately demonstrated for industrial boilers, and therefore could not be the best system. They also claimed SCR would be too expensive. However, the unit and technology configuration was practically identical between the industrial and utility boilers. Because of how similar the technology was, the EPA used data and analysis from both types of units to set the limits. That is similar to the proposed Carbon Pollution Standards, with an important difference: CCS has been, or is in the process of being, used on utility units at or beyond the level we have proposed.

b. EPA is explicitly required to consider cost in determining best technology available. By EPA's own estimate, adding CCS to a new coal-fired power plant adds somewhere between 60% and 80% to the total cost of the plant. How does this compare to the percentage increase in costs imposed by other control technologies EPA has required in the past?

RESPONSE: Our Regulatory Impact Analysis for the proposed Carbon Pollution Standards compares the levelized cost of electricity for new units across different generation technologies, including coal-fired generation with and without CCS. This assessment shows that super-critical pulverized coal generation (SCPC) costs about $92 per MWh (with climate uncertainty adder) and that integrated gasification combined cycle generation (IGCC) costs about $81 per MWh (without climate uncertainty adder). Our assessment of CCS on new units shows that SCPC with CCS costs between $88 and $110 per MWh while IGCC with CCS costs $97 - $109 per MWh depending on economic opportunities for carbon utilization and storage.

c. Would it be fair to say the costs for compliance with this single requirement would exceed the combined cost for all other CAA technologies required by EPA on new coal-fired power plants?

RESPONSE: New capacity projections from the EPA and EIA indicate that the proposed Carbon Pollution Standards are not projected to require changes in the design or construction of new EGUs from what would be expected in the absence of the rule. Thus, under both the baseline projections, as well as alternative AEO 2013 scenarios, the proposed standards are not projected to result in any emission reductions, monetized benefits, or costs.

3. In the proposal, EPA determined that partial CCS is BSER for coal but not for natural gas fired EGUs. The BSER analysis and factors EPA considered in making these contrasting determinations is strikingly different between the two categories. EPA appears to suggest that the legal framework for making BSER determinations changes based on the current economics of different fuel options.

a. Is this EPA's legal position? If so, on what authorities does this legal rationale rely?
b. Are there other variables that EPA believes would impact the factors the Agency considers in making a BSER determination?
c. To what extent is cost a determining factor?
d. What assumptions were made about the cost of natural gas and coal? Was this done regionally or does EPA assume that prices are uniform nationally?
e. At what price does coal power become competitive or advantaged over natural gas?
f. Have prices changed since the initial release of this proposal in September of 2013?
g. Are long-term contracting or stockpiling options the same for coal and natural gas?
h. How will the agency's conclusions change when these costs factors change substantially?

RESPONSE: Section 111(b)of the Clean Air Act (CAA) requires the EPA to identify the ''best system of emission reduction … adequately demonstrated'' (BSER) available to limit pollution. The CAA and subsequent court decisions identify the factors for the EPA to consider in a BSER determination:

- **Feasibility: The EPA considers whether the system of emission reduction is technically feasible.**
- **Costs: The EPA considers whether the costs of the system are reasonable.**
- **Size of emission reductions: The EPA considers the amount of emissions reductions that the system would generate.**
- **Technology: The EPA considers whether the system promotes the implementation and further development of technology.**

Cost is one of many considerations evaluated as part of a BSER determination, but the legal framework for determining BSER does not change as costs change. In the proposed Carbon Pollution Standards, the EPA analyzed the costs of both natural

gas and coal generation, including fuel prices. As detailed in the Regulatory Impact Analysis (RIA), the proposal accounts for projected regional coal and natural gas prices. The national average delivered prices for coal and natural gas used in this assessment are $2.94/MMBtu and $6.11/MMBtu (in 2011 dollars), respectively. In addition, the Agency also used a variety of sensitivity cases and alternative assumptions to demonstrate that the conclusions expressed in the proposal hold true at a wide range of natural gas prices.

The RIA also shows that new coal-fired generation without CCS approaches parity with new natural gas only when natural gas prices exceed $10/MMBtu on a levelized basis (in 2011 dollars). None of the EPA sensitivities or AEO 2013 scenarios project national average natural gas prices near that level. Industry investment patterns and the EPA's assessments are based on longer-term, annual projected fuel prices. Fluctuations in shorter-term prices over periods up to a year or two are influenced by a variety of factors, and are typically managed through a variety of hedging instruments matched to the corresponding period and pattern of spot prices. The Technical Support Document (TSD) accompanying the proposal entitled *Trends in Structure of Electric Power Sector Limiting Amount of New Coal* discusses the short term price volatility of both natural gas and coal.

Additionally, contracting and stockpiling options are similar in the coal and natural gas industries, but vary as a function of the different industry structures. The EPA considered the types of stockpiling options in making its assessments.

4. Do regulated parties have an interest in "fuel diversity"? Would such an interest support construction of coal fired power plants in the absence of the proposed NSPS?

RESPONSE: Integrated Resource Plans (IRPs) from utilities as well as some of the comments on the April 2012 proposal suggest that many utilities find value in factors such as fuel diversity and are willing to pay a premium for it. These IRPs suggest that a range of technologies can meet the preference for providing intermediate or base-load power from a diverse fuel mix.

As explained in the RIA for the proposed Carbon Pollution Standards, available data indicate that, even in the absence of this rule, (i) existing and anticipated economic conditions mean that few, if any, solid fossil fuel-fired EGUs will be built in the foreseeable future; and (ii) electricity generators are expected to choose new generation technologies (primarily natural gas combined cycle) that would meet the proposed standards.

5. In some regions of the United States, would the proposed NSPS prevent the construction of new coal-fired power plants or make the construction of such plants more expensive?

RESPONSE: The proposal would not prevent the construction of new coal-fired power plants. A number of projects are currently under construction that would meet this standard and several more are under development.

6. EPA's proposed rule states that the levelized cost of electricity (LCOE) for partial CCS is "comparable to other non-NGCC generation, after accounting for revenue from the sale of CO2 for EOR." EPA states that "[w]hen considered against the range of costs that would be incurred by projects deploying non-natural gas-fired electricity generation, the implementation costs of partial CCS are reasonable."

It is apparent that not everyone shares this assessment. For example, while the Energy Information Administration (EIA) considers LCOE to be "a convenient summary measure of the overall competitiveness of different generating technologies" it notes that "actual plant investment decisions are affected by the specific technological and regional characteristics of a project, which involve numerous other considerations." EIA further stated that "[s]ince projected utilization rates, the existing resource mix, and capacity values can all vary dramatically across regions where new generation capacity may be needed, the direct comparison of the levelized cost of electricity across technologies is often problematic and can be misleading as a method to assess the economic competitiveness of various generation alternatives."

a. Please provide any records demonstrating that EPA considered and/or rejected EIA's January 2013 assessment of LCOE.
b. Do you believe that use of LCOE in CAA rulemaking can be "problematic" and/or "misleading"? If not, please provide the committee with the technical basis for this assessment and your accompanying economic rationale.
c. EPA claims to have considered the costs of various BSER alternatives and to have rejected several lower cost options on the basis that they would not result in "significant reductions" in GHG emissions. What does EPA consider to be an acceptable cost-per-ton of CO_2 removed from utility electric generating units (EGUs)?

RESPONSE: LCOE is a widely used metric that represents the cost, in dollars per output, of building and operating a generating facility over the entirety of its economic life. Evaluating competitiveness on the basis of LCOE is particularly useful in establishing cost comparisons between generation types with similar operating characteristics, but with different cost and financial characteristics. The EPA has not established a cost-per-ton threshold in this proposal. The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants, because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale.

The analysis that the EPA performed for this proposal concerning costs is available in the rulemaking docket. The EPA will review comments on various metrics that the agency should consider, and evaluate and consider those in a final rulemaking.

7. Acting Assistant Secretary for Fossil Energy, Chris Smith, was asked by several Senators at a recent Senate hearing about his opinion on whether carbon capture and storage (CCS) is currently commercially available for power plant applications. In response he answered that "[all] components of CCS ... have been demonstrated worldwide" and that "[t]here are twelve large-scale CCS projects in operation worldwide today."

You also noted that the Agency relied on 12 large CCS projects.

a. Are any of these twelve projects a full-scale, base-load electric power plant?
b. Do any of these projects currently have a Class VI well permit?
c. For each of these 12 projects, please provide the Committee with:

1. A general description of the project, its location, and the electric generating capacity of the project, and the specific type of fuel the project uses.
2. The approximate date any planning initially began for the project or a previous iteration of the project.
3. The current status of the project.
4. Estimated completion date of the project.
5. Planned operating life of the project.
6. A technical description of the capture technologies, including detailed disclosure of any chemicals used in these systems.
7. Documentation of any commercial guarantees for capture technologies used in conjunction with any projects receiving federal funding.
8. Volume of CO2 currently captured; the annual volume of C02 anticipated to be captured when fully operational; and the total volume of C02 anticipated to be captured over the lifetime of the project.
9. Explain where, how, and under what regulatory and reporting systems the C02 will be stored.
10. The total federal, state, or municipal financial assistance the project has received or anticipates obtaining. Please include any grants, tax incentives, loan grantees, or rate recovery mechanisms.
11. Explain the parasitic load factor of the entire carbon capture, compression, transport, and storage system. Explain how this impacts the efficiency of the project as compared to the project without CCS.
12. Explain how the project foot print is impacted by the CCS system.
13. Provide the percentage of the overall cost of the project that is predominately related to the CCS portion of the project.
14. List any objections made to the project by any stakeholders, environmental groups, NGOs, or other individuals. Provide petitions for any challenges or objections that are currently pending. For any objections that have been resolved, provide concessions or alterations made that allowed the project to move forward.

RESPONSE: The EPA's proposed standards rely on a wide range of data, information and experience well beyond that generated by particular projects or studies. The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the U.S. that are currently capturing the CO2 for use in enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. The information that the EPA relied on to make this determination is available in the preamble for the rule and the technical support document (TSD) available at this link: http://www2.epa.gov/sites/production/files/2014-01/documents/2013_proposed_cps_for_new_power_plants_tsd.pdf. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

As of August 29, 2014, the EPA has issued four final Class VI well permits.

8. The proposed rule relies heavily on the potential for power plants to sell CO_2 to enhanced oil recovery (EOR) operators as a means of defraying the tremendous costs of CCS. However, EOR operators are signaling that the Subpart RR requirements in the proposed rule may be prohibitive.

A broad coalition of groups, from EOR operators to electric power providers, has raised concerns about EPA's plans. For example, the Committee received a letter from the Electric Reliability Coordinating Council (attached). Other members have submitted documents from companies like Denbury – each representing a range of companies and groups with concerns about the efficacy of EOR in relation to this rule.

a. Please explain in detail the new requirements for EOR operators that would accept CO_2 from power plants?
b. Have you spoken with any groups potentially impacted by the new Subpart RR reporting requirements? How have you taken their concerns into consideration?
c. Would reporting under Subpart RR potentially trigger the transition of an EOR well from Class II to Class VI under the UIC program-as EPA draft guidance suggests?
d. Since a significant part of EPA's economic justification for the proposed rule relies on the assumption that the CO_2 from power plants will be a valued commodity used in EOR operations: How do the economics of the proposed rule change if this is no longer an option?
e. Can you commit that EPA will not use reporting under Subpart RR to push any EOR operations into Class VI.

RESPONSE: The proposed Carbon Pollution Standards rely on the existing EPA requirements that are already in place for monitoring and permitting CO2 injection and geologic sequestration. Under the proposed Carbon Pollution Standards, if a new power plant decides to use CCS to comply with the standard, captured CO2 must be sent to a facility that meets the existing regulatory requirements for monitoring and reporting geologic sequestration. The EPA has an existing permitting framework in place under the Safe Drinking Water Act governing these kinds of projects and has been working closely with states and some facilities in the permitting process. A number of projects have been permitted under the existing regulatory framework, providing valuable experience and technical information to the EPA and states.

To be recognized as conducting geologic sequestration under the existing requirements (Subpart RR of the Greenhouse Gas Reporting Program), all facilities, including EOR, must conduct monitoring and reporting to show that the CO2 remains underground. For CO2 that is not recognized as being sequestered, EOR facilities can continue to report under the requirements for CO2 injection (Subpart UU of the Greenhouse Gas Reporting Program). The EPA believes that it is appropriate to rely on these same, existing requirements for the proposed new source rule, and will closely evaluate comments that we receive on this issue.

The regulations promulgating Subpart RR were finalized in 2010. The EPA spoke with stakeholders during the development of the requirements and carefully reviewed and responded to public comments as part of the rulemaking process that promulgated the Subpart RR requirements. An EOR project reporting under Subpart RR may be permitted as UIC Class II; it is not required to obtain a Class VI permit based on reporting. The regulatory provisions regarding transitioning from UIC Class II to UIC Class VI are set forth at 40 CFR 144.19 and focus on ensuring protection of Underground Sources of Drinking Water. Reporting under Subpart RR of the Greenhouse Gas Reporting Program is not one of the factors specified in 40 CFR 144.19(b).

9. EOR is not an option in many parts of the country, and geology is often unpredictable. EPA and others have suggested that new C02 pipelines could solve this problem. For example, portions of the Northeast that do not have access to an EOR market, or perhaps the right geology or legal structures for geologic sequestration, could build pipelines to states like Texas that could provide a market for C02 to be used in EOR.

a. As a rule of thumb, pipelines costs $200,000 per mile per inch of diameter. So for example, a 12-inch pipeline would cost roughly $2.4 million per mile. So a two thousand mile pipeline of modest size would cost roughly $5 billion to construct. Is this a cost EPA considers in the proposed rule? Does EPA consider this cost feasible?

b. Such a pipeline would also require a significant right of way along its two thousand mile path. How long would that take? Is there a federal authority that currently regulates interstate C02 pipelines? Does such a body have imminent domain authority over private land owners?

c. Could newly proposed changes to the Clean Water Act (CWA) impact the viability of utilizing Nation Wide Permitting authorities-thus requiring thousands of CWA 402 and 404 related permits prior to construction of such a pipeline? Given the environmental reviews required, how difficult might it be to build just one of the many pipelines that would be required for a nation-wide system of C02 pipelines? How did EPA take this into consideration?

d. Did EPA consider the potential non-air environmental impacts of the proliferation of CO2 pipelines?

RESPONSE: Carbon dioxide has been transported via pipelines in the U.S. for nearly 40 years. Approximately 50 million metric tons of CO_2 are transported each year through 3,600 miles of pipelines. Moreover, a review of the 500 largest CO_2 point sources in the U.S. shows that 95 percent are within 50 miles of a possible geologic sequestration site, which would lower transportation costs.

There are multiple factors that contribute to the cost of CO_2 transportation via pipelines including but not limited to: availability and acquisition of rights-of-way for new pipelines, capital costs, operating costs, length and diameter of pipeline, terrain, flow rate of CO_2, and the number of sources utilizing the pipeline. At the same time, studies and DOE quality guidelines have shown CO_2 pipeline transport costs in the range of $1 to $4 dollar per ton of CO_2. For these reasons, the transportation component of CCS is well-established as technically feasible and is not a significant component of the cost of CCS.

Furthermore, the EPA took comment on and companies are actively pursuing storage options that do not involve geologic sequestration. The EPA is reviewing the information or data on this issue that we receive during the public comment period.

10. This Committee is familiar with the communications between the Science Advisory Board and the Administrator as well as the meetings held in December 2013 and January, 2014 addressing CCS. The EPA staff who spoke on your behalf at that December 4-5, 2013 meeting said that looking at sequestration was outside their statutory obligation since other EPA programs would handle the storage or sequestration of the CO2.

Yet we can find no evidence of any cross media research conducted by the Office of Water or Office of Solid Waste to address the injection and storage of the C02 from new power plants. Your proposed rule's Technical Supporting Documents and other materials for the rulemaking point to the Class II programs for oil and gas injection wells. But for new coal-

fired or perhaps even natural gas-fired power plants, EOR is not helpful because they would not be located in states with oil and gas operations.

a. Please explain how future power plants would be permitted for C02 injection in parts of the country where EOR is not an option. What portion of the storage costs and liability will EPA be willing to subsidize? How did EPA assess these costs?
b. The NSPS proposal notes that UIC Class VI wells are an option. How many Class VI permits has the agency granted to date?

RESPONSE: Facilities using carbon capture are doing different things with the captured CO_2, ranging from EOR to storage to using it for food products. While it is true that selling captured CO_2 for EOR can generate revenue and help offset the costs of capturing carbon, this does not mean power plants can only build in areas near EOR.

As of August 29, 2014, the EPA has issued four final Class VI well permits.

11. Over the past few months, EPA staff told the Science Advisory Board that it was not allowed to examine EPA's assessment of injection and sequestration aspects of the proposed NSPS rulemaking.

a. Why was the SAB instructed to ignore sequestration issues?
b. How can the Agency both rely on the benefits of EOR sales for making a CCS system less expensive, and incorporate new storage requirements in the rule (Subpart RR) while simultaneously denying that CCS includes the storage half of the system?

RESPONSE: While the EPA has confidence that geologic sequestration is technically feasible and available, we recognize the need to continue to advance the understanding of various aspects of the technology. We have engaged with the SAB on key issues relating to sequestration and look forward to continuing to collaborate with the SAB on this important topic to ensure that our work is based upon the best available science.

The proposed Carbon Pollution Standards rely on the existing EPA requirements that are already in place for monitoring and permitting CO2 injection and geologic sequestration. Under the proposed Carbon Pollution Standards, if a new power plant decides to use CCS to comply with the standard, captured CO2 must be sent to a facility that meets the existing regulatory requirements for monitoring and reporting geologic sequestration. The EPA has an existing permitting framework in place under the Safe Drinking Water Act governing these kinds of projects and has been working closely with states and some facilities in the permitting process. Pilot projects have been permitted under the existing regulatory framework, providing valuable experience and technical information to the EPA and states.

To be recognized as conducting geologic sequestration under the existing requirements (Subpart RR of the Greenhouse Gas Reporting Program), all facilities, including EOR, must conduct monitoring and reporting to show that the CO2 remains underground. For CO2 that is not recognized as being sequestered, EOR facilities can continue to report under the requirements for CO2 injection (Subpart UU of the Greenhouse Gas Reporting Program). The EPA believes that it is appropriate to rely on these same, existing requirements for the proposed new source rule, and will closely evaluate comments that we receive on this issue.

After consideration of the clarifying information and thorough discussion about the issues during several meetings of the SAB that were open to the public, the workgroup recommended to the full SAB that additional review of the science of sequestration was not necessary in the proposed Carbon Pollution Standard. The full SAB agreed with the workgroup's assessment that the EPA did not propose to set any new requirements for sequestration in the Carbon Pollution Standards and that peer review of the DOE cost studies was sufficient. In a memo dated January 29, 2014, the SAB informed the EPA that it will not undertake further review of the science supporting this action.

12. In June of 2013, DOE released a "Mitigation Action Plan for the W.A. Parish Post-Combustion C02 Capture and Sequestration Project." (attached). In this document, DOE explained that carbon storage "activities are included in this project description because they are integrated into the project concept and considered connected actions."

a. Does EPA fully agree with this assessment?
b. Please explain EPA's rationale and legal justifications.
c. If EPA does not fully agree with this assessment, has or will EPA object? Why or why not?
d. Provide any documentation that EPA considered this or other determinations made by DOE or other agencies that CCS is a connected system that includes storage.

RESPONSE: The referenced report details the CO_2 capture project at the NRG W.A. Parish Plant near Houston, TX. The report describes the four primary components of the project to include: the CO_2 Capture Facility; the CO_2 Pipeline; the EOR Operations; and the CO_2 Monitoring Program. The use of captured CO_2 in EOR operations is an option that is discussed at length in the EPA's proposed Carbon Pollution Standards. The EPA has also discussed these components – the capture, the transport, the storage (in the case of the Parish project, utilizing the CO_2 for EOR), and the monitoring program – as being the major components of many CCS projects. However, the EPA also noted other opportunities for use of captured CO_2 that do not involve geologic storage – such as the Skyonic process that is discussed in the proposal.

13. At the January 21, 2014 SAB meeting, held by conference call, the EPA had speakers or witnesses from at least three utilities that discussed how CCS would not be feasible in their states for a number of reasons.

In one case, a speaker from New York State, explained that while they had adequate cap rock to hold the C02 into place in western New York, the operators realized that they could not get a performance warranty or guarantee for how much C02 could be injected. Further, the utility learned that the C02 injected would stretch beyond the subsurface owned by the city utility. Ultimately, they concluded that is not legal in the state of New York to inject C02 under another person's property. The project for CCS at that new coal-fired power plant was ceased as a result.

a. Does the Agency dispute the information presented by these witnesses or any others presented at this meeting?
b. Did EPA encourage the SAB to consider these comments? Why or why not.
c. Was EPA aware of the legal obstacles utilities face in many states?
d. Does EPA have the power to change these legal problems?
e. How did EPA factor in these obstacles?
f. What economic analysis did EPA undertake to understand the potential impacts of these practical and legal obstacles?

RESPONSE: The EPA welcomes public input on its proposed rules, and is currently reviewing comments on the proposed Carbon Pollution Standards.

In the proposal, the EPA has not mandated the use of CCS. Rather, the Agency has proposed emission standards that must be met by new electric generating units. State law may impose constraints on one or another type of facility, in which case different types of facilities can and will be built to meet needed electricity demand.

A new source developer would also have the option of transporting the captured CO2, via pipeline, to an area that is suitable for long term storage. Carbon dioxide has been transported via pipelines in the U.S. for nearly 40 years. Approximately 50 million metric tons of CO2 are transported each year through 3,600 miles of pipelines. Moreover, a review of the 500 largest CO2 point sources in the U.S. shows that 95 percent are within 50 miles of a possible geologic sequestration site.

14. The sole source aquifer program is an excellent example of where consultation should take place, since it is administered by EPA not states. There are about 77 sole source aquifers in the United States where the populations of those communities rely upon that aquifer for drinking water for at least 50% of the population. In fact in the western part of the U.S. a few communities rely almost entirely upon sole source aquifers for drinking water. While EPA staff did not address sole source aquifers before the SAB, the EPA staff said that all non-air issues would be addressed by other EPA regulatory programs.

a. How did EPA address the cross statutory issues related to the injection and sequestration of C02 if the injection must go through a sole source aquifer?
b. Please explain how EPA's Office of Air and Radiation and EPA's Office of Water communicated and considered the impact of the proposal on EPA's own special program dedicated to protection of sole source aquifers?
c. Please provide any communications or other documentation of these inter-agency communications.

RESPONSE: The EPA's Office of Air and Radiation and Office of Water have worked closely for a number of years to develop a regulatory framework that can ensure long-term safe geologic sequestration. The EPA's Underground Injection Control (UIC) Program, established under the Safe Drinking Water Act, established requirements to ensure that geologic sequestration is conducted in a way that geologic sequestration wells are appropriately sited, constructed, tested, monitored, and closed in a manner that ensures protection of all Underground Sources of Drinking Water (including sole source aquifers). Thus, the location of a sole source aquifer would be a potential consideration for UIC permitting. The proposal does not change any of the requirements to obtain or comply with a UIC permit for facilities that are subject to the EPA's UIC Program under the Safe Drinking Water Act.

15. On March 6, 2014 our colleagues from the Senate Environment and Public Works Committee inquired whether EPA had conducted any consultation with the Fish & Wildlife Service (FWS) regarding the Endangered Species Act (ESA) and whether a full analysis has taken place under the ESA.

As you are aware, Section 7 of the ESA requires the FWS consultation on any action that "may effect" a listed species or designated critical habitat. As the Senators pointed out, because the NSPS effectively removes coal as an option for electric power generation, the nation will need to rely on other energy resources, like nuclear, natural gas and renewables. This shift will certainly require additional habitat and the use of resources that have a history of harming endangered species.

You testified that EPA has not consulted with the FWS in regard to the proposed rule for new power plants.

a. Why did EPA choose not to consult with the FWS in drafting this rule?
b. Has EPA consulted with the FWS in regard to the upcoming existing source rule? Why or why not?

RESPONSE: Any final rules the Agency issues for carbon pollution from new or existing power plants will be based on sound science, will comply with all applicable legal requirements (including the Endangered Species Act), and will also address any significant comment we received on the applicability of the ESA.

16. You testified that since the components of CCS have been used by other industries, fully integrated CCS systems have been "adequately demonstrated" for power plants. But the GHG NSPS's own cited literature explains that "even when component technologies work well, they need to work well within an integrated CCS system." Isn't EPA's own research correct- isn't there a difference between demonstrating the components of CCS and demonstrating CCS as a fully integrated system?

RESPONSE: The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants, because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the United States that are currently capturing the CO2 for use in enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

17. EPA cites three studies in the "literature" section of the new standard's "technical feasibility" discussion of CCS. Yet, EPA leaves out that one of those studies concludes that "there is truth to the often heard assertion that CCS has never been demonstrated at the scale of a large commercial power plant." Another study assumes carbon capture is "unproven technology." And the other study- which EPA co-drafted – says that carbon capture has "not been demonstrated at a scale necessary to establish confidence for power plant application." How does EPA explain these apparent inconsistencies?

RESPONSE: EPA's proposed standards rely on a wide range of data, information and experience well beyond that generated by particular projects or studies. The EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the U.S. that are currently capturing the CO2 for use in enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

18. In EPA's first NSPS proposal in 2012, the agency determined that carbon capture and storage technology was not the best system of emissions reduction for new coal power plants. A year later, in this latest proposal, EPA says it is now the best system for emission reduction. Please explain with specificity exactly what changed in a year and a half to

allow EPA to reach a different conclusion on the technical and economic feasibility of CCS?

RESPONSE: The EPA received more than 2.5 million comments on the April 2012 proposed rule. Among the topics discussed in those comments was the degree to which CCS has been adequately demonstrated as BSER for coal-fired power plants. After the consideration of information provided in those comments, the EPA has proposed to determine that CCS is technically feasible for new coal-fired power plants, because all of the major components of CCS – the capture, the transport, and the injection and storage – have been demonstrated and are currently in use at commercial scale. For example there are several industrial projects in the United States that are currently capturing the CO2 for use in enhanced oil recovery (EOR) or other applications. There have been numerous smaller-scale projects that have demonstrated the technology, and there are several full-scale projects – both in the U.S. and internationally – that are under construction today. Thus, the EPA has proposed to determine that partial CCS is the Best System of Emission Reduction (BSER) for new coal-fired power plants.

19. Section 1-3 of NSPS Regulatory Impact Analysis, EPA stated that "even in the absence of this rule, existing and anticipated economic conditions will lead electricity generators to choose new generation technologies that meet the proposed standard without the need for additional controls."

a. If that is the case, why did EPA expend substantial resources adopting a rule that it asserts will have no impact on "new construction" of electric generation facilities?

b. EPA also states that it "anticipates that the proposed EGU New Source GHG Standards will result in negligible C02 emission changes, energy impacts, quantified benefits, costs, and economic impacts by 2022." Why is EPA engaged in a regulatory proceeding for which EPA's own analysis states will result in "negligible, quantified benefits, costs, and economic impacts by 2022"?

c. Why does EPA conclude that its NSPS proposal would "provide an incentive for supporting research, development, and investment into technology to capture and store C02" if EPA predicts that, even absent NSPS, there would be no new "coal-fired power plant" construction and thus no need to "implement[t] some form of partial capture and storage" for such plants?

d. What is the basis for EPA's recognition that "a few companies may choose to construct coal or other solid fossil fuel-fired units" in the absence of the proposed NSPS? *See* Section 1-3 of NSPS Regulatory Impact Analysis.

RESPONSE: Power plants are the biggest emitters of carbon pollution. This proposed rule will make sure any new power plants use modern technology to minimize this harmful carbon pollution. Because these standards are in line with current industry

investment patterns, these standards are not expected to have notable costs and are not projected to impact electricity prices or reliability. The Department of Energy, the EPA and industry projections indicate that new power plants that are built over the next decade or more would be expected to meet these standards even in the absence of the rule. EIA projections and EPA analysis indicate that utilities are most likely to choose to build new power plants that would already meet the standards proposed in this rule (natural gas or coal with partial CCS) or are not covered by this rule (renewables, nuclear, or simple cycle turbines that only sell a portion of their output to the grid).

20. Is it EPA's position that the proposed NSPS will have no tangible impact on the parties that it regulates?

a. If EPA believes that the proposed NSPS will have tangible impacts on regulated parties, what are those impacts?

b. If EPA believes that the proposed NSPS will have no tangible impacts on regulated parties, why is EPA engaged in a costly and resource-intensive proceeding that will have no impact in the real world?

RESPONSE: The U.S. Supreme Court ruled that GHGs meet the definition of "air pollutant" in the Clean Air Act, and EPA has determined that they may reasonably be anticipated to endanger the public health and welfare. Therefore it is important to ensure that new fossil fuel-fired power plants use the best available technology to limit their emissions of carbon dioxide, the most prevalent greenhouse gas. Because these standards are in line with current industry investment patterns, these standards are not expected to have notable costs and are not projected to impact electricity prices or reliability. However, this rule will ensure that the next generation of fossil fuel-fired power plants in this country will use modern technologies that limit harmful carbon pollution.

21. In 1997, EPA proposed standards to reduce nitrogen oxide (NOx) emissions from utility and industrial steam generating units under CAA section 111(b). For the subpart Da sources covered by the proposed rule, EPA calculated the nationwide increase in annualized costs as well as the cost-effectiveness of the proposed standards, *e.g.*, cost-per-ton of Nox removed.

While EPA also examined the resulting cost of the standards with regard to the price of electricity, EPA stated that "the goal of the economic impact analysis was to estimate the market response to the proposed changes to the existing standards for NOx emissions . . . The analysis did not quantitatively address the possibility of changing technology, fuel, or capacity utilization in response to the proposed revisions . . ." In addition, while EPA looked at the impact of the rules on electricity prices generally, the Agency specifically examined the price changes on a facility basis, estimating that such costs could be as high as 6 percent. EPA's final rule did not depart from this economic analysis.

The proposed GHG NSPS, however, uses a LCOE to measure the "reasonableness" of the proposed standards. New coal-fired generation with partial CCS is compared to the LCOE of a new nuclear power plant and EPA concludes that "the cost of new coal-fired generation that includes CCS is reasonable today."

a. In the Proposed Ru1e, EPA claims that case law stretching back 40 years in the D.C. Circuit requires EPA to consider different factors, including that the costs of "the system must be reasonable." But in the Proposed Rule, EPA simply equates the LCOE with what is "reasonable," ignoring past practice where EPA examined facility costs in determining the Best System of Emission Reduction under CAA section 111.

    1. Please provide a detailed explanation of why EPA failed to consider the cost of the proposed rule on individual facilities.
    2. When and on what rationale did EPA determine it would vary from past practice in examining costs when setting BSER under CAA section 111?
    3. Explain why EPA's use of LCOE is superior to the examination of the costs expected to be incurred by individual facilities, in terms of up-front capital costs and the cost per ton of pollution reduced.

RESPONSE: The EPA's economic analysis is based on the expected costs and benefits of the rule, including costs to individual facilities.

There are a number of ways that control costs can be expressed. The Levelized Cost of Electricity (LCOE) is a widely used metric that represents the cost, in dollars per output, of building and operating a generating facility over the entirety of its economic life. Evaluating competitiveness on the basis of LCOE is particularly useful in establishing cost comparisons between generation types with similar operating characteristics, but with different cost and financial characteristics. This measure is consistent with the way costs are presented in DOE/NETL reports evaluating the cost and performance of new fossil fuel-fired EGUs, both with and without CCS.

The EPA is reviewing and considering comments on various metrics that the Agency should consider.

b. Since EPA has proposed that partial CCS is BSER for subpart Da units, please provide the Committee with EPA's estimate of the cost (in$ per ton of C02 avoided and assuming no EOR potential) of partial CCS on a "typical" baseload subpart Da unit, 550 MWe or above, operating at or above 85% capacity. Please include enough detail to determine EPA's assumptions for the costs of capture, transport, sequestration, and monitoring.

RESPONSE: The EPA provided several metrics to show the relative emission profiles, costs, efficiencies, and performance of new fossil fuel-fired electric generating units to

provide context around some of the current investment decisions that utilities and other power producers are contemplating. The analysis is centered on future projections of new power plant deployment from both the EPA and the EIA, which show that the economics support building new natural gas combine cycle technology and other non-emitting sources of electric generation. This analysis incorporated a significant number of side-cases and additional analysis where alternate assumptions regarding future electric demand, natural gas prices, coal prices, benefits of enhanced oil recovery, and carbon uncertainty costs were adjusted. The use of alternative calculations demonstrate that the Agency's conclusions are robust across a wide set of assumptions.

To supplement these findings, the EPA also provided discussion of the levelized cost of electricity and compared the cost and performance of new fossil fuel-fired electric generating technologies, including illustrative benefits of emission reductions. The EPA's Regulatory Impact Assessment provides details of these assessments that relate to your question, including but not limited to:

- **Table 5-5: Technology Cost and Performance**
- **Figure 5-7: Levelized Cost of Electricity, Uncontrolled Coal and Coal with Full and Partial CCS**
- **Table 5-10: Illustrative Emissions Profiles, New Coal and Natural Gas-Fired Generating Units**
- **Table 5-14: 2020 Incremental Benefits of Emission Reductions from Coal-Fired Generation with CCS meeting 1,100 lbs/MWh Relative to New Coal-Fired Generation Without CCS**

22. As you know, power plants are just one of approximately 70 different industrial source categories that EPA regulates under the Clean Air Act. Those categories include nearly every sector of the industrial economy-manufacturing, refineries, steel plants, sewage treatment, fertilizer plants, cement production, and so on. In previous testimony to Congress, Administrator McCarthy refused to rule out new regulations on carbon emissions from these sectors. EPA has an obligation to provide these industries as well as Congress and the public clarity on its plans.

a. Can you tell us if EPA has ruled out greenhouse gas regulations on any of these sectors? If so, which ones, and of the remaining sectors that you do plan to regulate, which ones will be first?
b. What are the implications of this new definition of the "Best System of Emission Reduction"? Might it be used in other rules?
c. Can you assure us that outside groups will not have the power to force the Agency to require CCS in other contexts?

RESPONSE: The EPA is not currently developing national standards to specifically regulate greenhouse gas (GHG) emissions from source categories other than fossil fuel-fired power plants. Were the EPA to propose a New Source Performance Standard that would limit GHG emissions from another source category, the proposal would be based on the best available science and data, including information about all

applicable regulations, to determine what standard represents the Best System of Emissions Reduction as defined by the Clean Air Act. In addition, the EPA would reach out to and engage all interested stakeholders. For example, we are taking comment on whether to directly account for methane from landfills.

23. The GHG NSPS is being sold to the public based on EPA's linking of C02 emissions to potential negative impacts of climate change. Yet the proposed rule states that the GHG NSPS "will result in negligible C02 emission changes…by 2022."

a. How much C02 does EPA estimate that the 111 (b) proposal will prevent between its initial proposal and the 8-year window for review?
b. Has EPA modeled the climate impacts of these anticipated reductions? Why or why not? If so, please provide the assumptions included in this modeling.
c. President Obama's executive order on regulations requires that for any regulation, the benefits must justify the cost. In light of the absence demonstrated benefits associated with this proposal, how do these new standards meet the President's cost-benefit requirement?

RESPONSE: Because these standards are in line with current industry investment patterns, these standards are not expected to have notable quantifiable costs or benefits. However, this rule will ensure that the next generation of fossil fuel-fired power plants in this country will use modern technologies that limit harmful carbon pollution.

24. You testified that EPA's upcoming 111(d) rule will allow states both primacy and great flexibility in determining C02 requirements for the existing units. However, EPA made the same type of statements when it adopted its regional haze regulations and guidelines, and those statements turned out not to be true. I understand 15 states and state agencies have filed a brief with the Supreme Court complaining that EPA in fact has not allowed states flexibility in determining regional haze requirements and instead has overridden state judgments and imposed federal plans in twelve different states. The EPA wants the states' utilities to spend billions of dollars – in addition to the hundreds of millions of dollars that the utilities are othe1wise spending-to install controls that will result in little, if any, improvement in visibility.

With the states having been burned in the regional haze program, why should they believe EPA's statements now about giving states flexibility in C02 programs?

RESPONSE: The EPA has approved over 90 percent of Regional Haze SIPs that were submitted. In a limited number of cases, we had to substitute full or partial federal plans where the state SIP did not fully address the regional haze rule requirements. Only three full FIPs were required (Montana, Hawaii, and Virgin Islands). These three full FIPs were promulgated in cooperation with state/territorial officials because they did not have resources to complete SIPs on their own.

25. In order to bolster the cost feasibility of the NSPS GHG New Plants rule, EPA heavily emphasizes the marketability of C02 to be used in the production of crude oil through enhanced oil recovery (EOR). In fact, the proposed rule and along with the Regulatory Impact Analysis mention 'enhanced oil recovery' or 'EOR' more than 130 times.

However, a 2009 peer-reviewed paper published in Environmental Science & Technology found that EOR as a method of sequestering C02 leads to net increases in C02 emissions. The paper, *Life Cycle Inventory of C02 in an Enhanced Oil Recovery System* found that when oil is produced *"93% of the carbon in petroleum is refined into combustible products ultimately emitted into the atmosphere."* The study concluded that:

> *"The net emissions from* [CCS EOR] *systems are positive meaning that the GHG emissions are larger than the C02 injected and stored in the reservoir.* "
>
> *"We calculated that between 3.7 and 4.7 metric tons of C02 are emitted for every metric ton of C02 injected"*

a. Wouldn't this finding-that pairing carbon capture and sequestration with enhanced oil recovery – defeat the fundamental purpose of EPA's proposed rule?
b. The Agency's favorite example of the potential for partial CCS is the Kemper plant in Mississippi and its associated EOR project. In December, Denbury Resources told the Associated Press that without the Kemper plant "they would not be able to produce oil there otherwise." So in EPA's model CCS case, the Kemper plant, the oil would not be produced without Kemper. In this light, wouldn't it be reasonable to assume that the CCS EOR project at Kemper could lead to a net increase in C02 emissions?

RESPONSE: The amount of oil produced through EOR with captured CO2 from new EGU's subject to this proposal would vary by project, but likely would have a negligible impact on total oil consumption – and thus on total CO2 emissions from oil production and consumption. Section 111 of the Clean Air Act authorizes the EPA to promulgate emissions standards for specified source categories, in this case fossil fuel-fired power plants. To be recognized as conducting geologic sequestration under the existing requirements (Subpart RR of the Greenhouse Gas Reporting Program), all facilities, including EOR, must conduct monitoring and reporting to show that the CO2 remains underground.

26. During the first day that President Obama took office, the White House website declared his administration would become "the most open and transparent in history" and the President issued high-profile orders pledging "a new era" and "an unprecedented level of openness" across the entire federal government. The Administration initially estimated the "Social Cost of Carbon" to be $22 per ton. Since then, it has been revised again and yet again. Notice of the most recent estimate came in a little-known rule on microwave ovens issued by the DOE and the cost went to $36. For a decision with such broad implications, there's very little disclosure regarding how these "costs" are being calculated and which

federal officials are participating, and which outside groups are contributing to the inter-agency task force**.**

a. Who are the specific EPA officials participating in the "social cost of carbon" task force and helping to create these calculations?
b. Does EPA have any separate or independent efforts to set a "Social Cost of Carbon"?
c. Was this factored into the NSPS proposal in any way? Why or why not?

RESPONSE: The EPA works with OMB to ensure that EPA is following guidance in assessing the costs and benefits of their agency actions. The Social Cost of Carbon (SCC) estimates were developed by an interagency working group convened by OMB and the Council of Economic Advisors (CEA). This group worked together to coordinate development of both the 2010 Technical Support Document (TSD) addressing the estimates and the May 2013 technical update and related TSD. EPA officials from the Office of Policy (OP) and the Office of Air and Radiation (OAR) participated in the interagency SCC discussions, including technical staff (economists and climate scientists) from the National Center for Environmental Economics in OP and the Office of Atmospheric Programs in OAR.

On August 25, 2014, GAO released its review of the process used to develop the SCC estimates. It concluded that the working group (1) used consensus-based decision-making, (2) relied on existing academic literature and modeling, and (3) took steps to disclose limitations and incorporate new information by considering public comments and revising the estimates as updated research became available. The report made no recommendations.

In the Regulatory Impact Analysis that accompanied the carbon pollution proposal, the primary conclusion was that the proposal would have no notable costs or benefits because current planned generation would meet the proposed standards even in the absence of the rule. The SCC was only applied in illustrative analyses of the impacts of changes to natural gas prices or limited circumstances where an electric utility would choose to build a coal-fired unit with CCS. The revised estimates for the social cost of carbon – released in November 2013 -- do not impact the RIA's primary conclusion that the proposed Carbon Pollution Standards for New Power Plants will have negligible costs and no quantified benefits, nor do they change the conclusions of the illustrative analyses.

27. Discussions by outside groups of potential uses of Section 111(d) to regulate existing power plants have indicated that this kind of approach in conjunction with other impending EPA deadlines would require that 1) a large number of coal-fired plants be mothballed; and 2) energy demands will have to be reduced through efficiency measures such as making it more expensive for consumers to use appliances at certain time of day.

a. Is EPA open to adopting a proposal that encourages or necessitates price hikes for consumers?
b. What number of power plant closures would EPA consider acceptable?
c. What are the impacts on reliability when EPA considers these rules in the aggregate?

RESPONSE: The Clean Power Plan proposal, which was published in the *Federal Register* on June 18, 2014, provides states with the flexibility to determine how to achieve the reductions in the state goals and to adjust the timing in which reductions are achieved, in order to address key issues such as cost to consumers, electricity system reliability and the remaining useful life of existing generation assets. For this proposed rule, the EPA examined the effects of the proposal on reserve margins and reliability planning. Our analysis concludes that the Clean Power Plan is not expected to raise concerns over regional resource adequacy. For more information, please refer to the Regulatory Impact Analysis and to the Technical Support Document titled Resource Adequacy and Reliability Analysis.

For more than 40 years, the Clean Air Act has fostered steady progress in reducing air pollution, allowing Americans to breathe easier and live healthier – all while the economy has more than tripled and an affordable, reliable energy system has continued to operate. We remain committed to maintaining all of those outcomes.

28. What analyses has EPA conducted regarding the practicality and legality of using Section 111(d) of the Clean Air Act to regulate existing power plants?

a. Does EPA believe it has the legal authority to consider potential reductions outside the fence line in setting "achievable" standards? If so please explain in detail. If not, please explain why not**.**

b. Do you believe EPA has the authority under the Clean Air Act to establish a climate change program for existing power plants, such as the one called for by the NRDC?

RESPONSE: The features of the proposed Clean Power Plan are explained in detail in the preamble to the proposed rule and other materials that the EPA has provided on its website, including a legal memorandum providing background for the legal issues discussed in the preamble. We invite comments on all aspects of the Clean Power Plan proposal.

29. Who will be reviewing the comments submitted to the EPA's rulemaking docket for the NSPS **I11**(b) proposal**?**

a. How many EPA employees will review comments submitted? How many hours per week will these employees review comments?
b. Will EPA contract out any of this review to non-EPA employees? If so, please detail exactly what portions of the process and the cost of such review.
c. Will EPA use contractors to draft any Agency responses?
d. Will EPA use computers to sort, collate, or otherwise stream line comments?
e. Does EPA utilize any methodology to identify computer generated or substantially similar comments? How are these types of comments considered when tabulating the number of favorable or unfavorable comments? Do these comments receive the same weight as unique comments?
f. Are there any types of comments the Agency will not consider?

RESPONSE: EPA staff, with support from paid contractors, will review all public comments received, but the EPA does not anticipate using contractors to draft responses to comments. The EPA does use computers in reviewing and responding to comments.

The EPA docket office does differentiate between "Mass Mail Comments" and "Posted Unique Comments." The EPA will consider any comment germane to the proposed regulation, and will develop a final rule considering the content of all comments.

30. Does the Agency believe that it has the legal authority to propose NSPS 111(d) C02 standards for existing EGUs before finalization of its 111 (b) proposal?

a. If so, please provide a detailed legal rationale and any supporting examples or precedent.
b. If not, please provide a detailed legal rationale and any supporting examples or precedent.

RESPONSE: The features of the proposed Clean Power Plan are explained in detail in the preamble to the proposed rule and other materials that the EPA has provided on its website, including a legal memorandum providing background for the legal issues discussed in the preamble. We invite comments on all aspects of the Clean Power Plan proposal.

31. On what date does the Agency believe its 111(b) NSPS proposal was officially proposed? Please provide a detailed legal rationale and any supporting examples or precedent.

RESPONSE: The NSPS published in the *Federal Register* on January 8, 2014.

32. By what date does the Agency believe its 111(b) NSPS proposal must be finalized for purposes of compliance with deadlines included in the Clean Air Act? Please provide a detailed legal rationale and any supporting examples or precedent. .

RESPONSE: The Clean Air Act states the EPA should issue a final rule within one year after publication in the *Federal Register*.

33. Please explain EPA's rational for not including modified sources in the 111(b) proposal. Provide a detailed legal rationale and any supporting examples or precedent.

a. Will the Agency propose a separate rule for modified sources under section 111 or will this rule be combined with the upcoming 111(d) proposal? Provide EPA's legal rationale for this decision.

b. What will be the triggering thresholds for modification? Provide a detailed legal rationale for this decision

c. What will be the effective date for the section 111 modified source rule – p proposal, finalization, or some other date? Provide a detailed legal rationale and any supporting examples or precedent.

RESPONSE: The EPA issued proposed Carbon Pollution Standards for modified or reconstructed power plants on June 2, 2014, and this proposal was published in the Federal Register on June 18, 2014. The proposal would apply to units that meet certain, specific conditions described in the Clean Air Act and implementing regulations for being "modified" or "reconstructed." Under existing regulations, which we did not propose to amend, modification is any physical or operational change to an existing source that increases the source's maximum achievable hourly rate of air pollutant emissions. Under these same regulations, a reconstructed source is a unit that replaces components to such an extent that the capital cost of the new components exceeds 50 percent of the capital cost of an entirely new comparable facility. Because the Clean Air Act defines a new source based on reference to the proposal of applicable standards, sources that commence reconstruction or modification after June 18, 2014 will be subject to the standard of performance for modified and reconstructed units. The proposed emission limits would apply to affected sources upon the effective date of the final regulation.

34. Do you support the principle that EPA should not propose or finalize regulations unless the scientific and technical information relied on is: specifically identified; and publicly available in a manner that is sufficient for independent analysis and substantial reproduction of research results?

RESPONSE: The EPA is committed to transparency with regard to the scientific bases of agency decision making. The science on which regulatory and other decisions are based should be made publicly available consistent with the law.

35. Several important elements of your proposed standard rely heavily or exclusively on the use of the Integrated Planning Model, a proprietary model, instead of public energy models like NEMS.

a. How is this consistent with EPA's Scientific Integrity Policy, which states "the use of nonproprietary data and models are encouraged, when feasible, to increase transparency"?
b. Was it not feasible to rely on a nonproprietary model?
c. Please provide all EPA contracts, grants, and agreements related to the Integrated Planning Model since 2008.

RESPONSE: The EPA's use of the Integrated Planning Model is consistent with the Agency's Scientific Integrity Policy. All of the underlying data, assumptions, modeling parameters, and related information is published on the IPM modeling website and is publicly available. In addition, IPM undergoes periodic formal peer review, which includes separate expert panels for both the model itself and the EPA's key modeling input assumptions. The rulemaking process also provides opportunity for expert review and comment by a variety of stakeholders, including owners and operators of the electricity sector that are represented by the model, public interest groups, and other developers of U.S. electricity sector models. The EPA is required to respond to significant comments submitted regarding the inputs used in IPM, its structure, and application. The feedback that the Agency receives provides a highly detailed review of key input assumptions, model representation, and modeling results.

The Honorable Marc Veasey

1. How will EPA enforce the Green House Gas Reporting requirements under subpart RR for EOR operators utilizing Class II wells if they use C02 related to the proposed New Source Performance Standard (NSPS)?

RESPONSE: The compliance and enforcement provisions related to the Greenhouse Gas Reporting Program are set forth at 40 CFR 98.8.

2. If an EOR operator utilizes its current C02 from natural and industrial sources, and C02 captured as a result of the NSPF, will they have to report all EPA GHG requirements under subpart RR?

RESPONSE: The proposed Carbon Pollution Standards rely on the existing EPA requirements that are already in place for monitoring and permitting CO2 injection and geologic sequestration. Under the proposed Carbon Pollution Standards, if a new power plant decides to use CCS to comply with the standard, captured CO2 must be sent to a facility that meets the existing regulatory requirements for monitoring and reporting geologic sequestration. The EPA has an existing permitting framework in place under the Safe Drinking Water Act governing these kinds of projects and has been working closely with states and some facilities in the permitting process. Pilot projects have been permitted under the existing regulatory framework, providing valuable experience and technical information to the EPA and states.

To be recognized as conducting geologic sequestration under the existing requirements (Subpart RR of the Greenhouse Gas Reporting Program), all facilities, including EOR, must conduct monitoring and reporting to show that the CO2 remains underground. For CO2 that is not recognized as being sequestered, EOR facilities can continue to report under the requirements for CO2 injection (Subpart UU of the Greenhouse Gas Reporting Program). The EPA believes that it is appropriate to rely on these same, existing requirements for the proposed new source rule, and will closely evaluate comments that we receive on this issue.

3. What additional requirements would have to be met for a Class VI well as opposed to a Class II well utilizing EOR and who has the authority to make the decision to reclassify a well?

RESPONSE: The regulatory provisions regarding transitioning from UIC Class II to UIC Class VI are set forth at 40 CFR 144.19. The Federal requirements for Class II wells and Class VI wells are set forth at Part 146 Subparts C and H, respectively.

The Honorable Randy Neugebauer

1. I continue to be concerned that EPA isn't truly using a technology that is adequately demonstrated in its rules for new power plants, and continues to cite facilities that aren't even built yet, much less operating full-scale CCS.

In fact, in three of the cases cited by EPA in support of the NSPS rule, the plants are not yet even constructed. In the fourth, the Kemper project in Mississippi, they seem to be capturing the C02 but they aren't injecting it into ground for any kind of storage. This appears to be a "catch and release" approach to CCS, not the full scale demonstration that would be required of future power plants.

But when the Kemper facility is eventually ready to send the captured C02 to an EOR operator, the Kemper has essentially been grandfathered in, and the new rules proposed for EOR operators won't apply in this case. Clearly, this was necessary to keep the Kemper project moving forward, since applying the new EOR rules would likely put Kemper out of business, as EOR would be unlikely to remain a revenue stream for Kemper under the new reporting requirements.

The fact is, this proposal is so radical that even before we finish building the world's very first attempt at a fully equipped CCS power plant, the EPA's own poster child power plant cannot meet the requirements of the rule, and needs to be grandfathered in. With that consideration in mind:

a. How would a future facility like Kemper ever manage to be in compliance with NSPS rules with EOR off the table?

b. Kemper is already heavily subsidized by the federal government – would more government money be required to make this model work without EOR revenue?

c. Why would the EPA design a rule that would essentially prohibit a primary private sector funding source for CCS, the technology they seem determined to require across the board?

RESPONSE: The proposed new source performance standards would be applicable to units that "commence construction" after the date of proposal, January 8, 2014. Since the Kemper facility commenced construction prior to that date, it would be considered an existing source. Therefore, the Kemper facility would not be an affected facility.

For future facilities under the proposed standards, captured CO_2 must be sent to a facility that meets the existing regulatory requirements for monitoring and reporting geologic sequestration. In order to be recognized as conducting geologic sequestration under the existing requirements (Subpart RR of the Greenhouse Gas Reporting Program), all facilities – including EOR – must have monitoring and reporting that shows that the CO_2 is staying underground. For CO_2 that is not recognized as being sequestered, EOR facilities can continue to report under the requirements for CO_2

injection (Subpart UU of the Greenhouse Gas Reporting Program). The EPA believes that it is appropriate to rely on these same, existing requirements for the proposed new source rule, and is closely evaluating comments received on this issue.

The Honorable Cynthia Lummis

1. On December 6, 2013, I sent a letter with then Chairman Stewart and seven other Committee members expressing serious concerns about the EPA's "listening sessions tour," designed, according to the Agency, to "solicit ideas and input from the public and stakeholders about the best Clean Air Act approaches."

The day before our March 12, 2014 hearing, you sent a letter to several members of the Committee stating that the "Administrator has asked that [you] respond on her behalf." Thank you for your detailed response.

Enclosure 2 provides a "List of EPA Meeting with and Outreach to Stakeholders in Select States" represented by those of us who sent the original letter. With regard to this table, please specify for each meeting noted:

a. The physical location of the meeting.
b. Whether the meeting was open to the public.
c. How and when were members of the public and stakeholders notified of the meeting.
d. Whether the meeting was transcribed or recorded.

RESPONSE: Locations, attendees, and other details of the meetings in question varied, in part depending on whether the meetings were initiated by the EPA or by others.

2. During our hearing, I asked you a question regarding this issue, but wanted to follow up in writing. As I noted, EPA's current permitting guidance for GHG emissions requires all units that need a PSD permit for GHG emissions to evaluate CCS. In fact, this guidance classifies CCS as an "add-on pollution control technology" that is "available."

a. Why does EPA guidance require a CCS analysis for new natural gas-fired units, including power plants as well as boilers and heaters within manufacturing plants?
b. Please outline the specific conditions under which EPA would require CCS for either natural gas fired utility units or non-utility boilers and heaters? If EPA would not require the use of the CCS for these sources, why is the Agency requiring this analysis?
c. If EPA does not believe as a general matter that CCS should be required for these natural gas-fired units, why hasn't EPA issued a memorandum to states noting that this analysis is not required as a general matter for these combustion sources?
d. Has EPA considered the regulatory uncertainty and permitting delays that result from declaring in your PSD guidance that CCS is "available" and for requiring a CCS analysis on natural gas-fired sources, including manufacturing combustion devices?

e. Has EPA undertaken comprehensive modeling of the impacts this regulatory uncertainty has had on job creation given that it may delay the construction of manufacturing plants?

RESPONSE: Permitting under the Prevention of Significant Deterioration (PSD) program requires a source-specific analysis of all "available" control options for the pollutant under evaluation. To satisfy the Clean Air Act requirement of best available control technology (BACT), the BACT analysis should focus on technologies that have been demonstrated to achieve the highest levels of control for the pollutant in question. Since CCS is a demonstrated technology that achieves a high level of control of carbon dioxide, it is reasonable to expect that a GHG BACT analysis for certain types of sources would consider CCS as an available technology. To disregard an available technology, such as CCS, in the BACT review process would be counter to the principles laid out in the Clean Air Act definition of BACT and in the historical policies of the EPA and other permitting authorities, and could jeopardize the defensibility of the final permit, if challenged.

The Clean Air Act and corresponding implementing regulations require that a permitting authority conduct a BACT analysis on a case-by-case, site-specific basis, and the permitting authority must evaluate the amount of emissions reductions that each available and technically feasible control technology would achieve, as well as the energy, environmental, economic and other costs associated with each technology or technique. A memorandum by EPA notifying states that a particular class or category of source need not evaluate an available control option such as CCS in this context would improperly prejudge the outcome of the analysis that is required by statute to be conducted on a case-by-case basis for each individual source seeking a permit.

Contrary to your statement, the EPA's permitting guidance does not require an assessment of CCS for all types of sources seeking a PSD permit for GHG emissions. The EPA views the availability of CCS as limited to certain types of sources. The guidance states, in relevant part:

> ***For the purposes of a BACT analysis for GHGs, EPA classifies CCS as an add-on pollution control technology that is "available" for facilities emitting CO2 in large amounts, including fossil fuel-fired power plants, and for industrial facilities with high-purity CO2 streams (e.g., hydrogen production, ammonia production, natural gas processing, ethanol production, ethylene oxide production, cement production, and iron and steel manufacturing). For these types of facilities, CCS should be listed in Step 1 of a top-down BACT analysis for GHGs. This does not necessarily mean CCS should be selected as BACT for such sources. Many other case-specific factors, such as the technical feasibility and cost of CCS technology for the specific application, size of the facility, proposed location of the source, and availability and access to transportation and storage opportunities, should be assessed at later steps of a top-down BACT analysis.***

3. EPA is also requiring CCS analyses for LNG facilities. Further, the EPA Environmental Appeals Board (EAB) appears to be reviewing a challenge by the Sierra Club on whether CCS should be required at LNG facilities. What effect does this regulatory uncertainty created by the Agency have in potentially delaying the much needed export of natural gas?

RESPONSE: The EPA is not aware of a PSD permit for an LNG facility that is under EAB review.

BACT is a case-by-case assessment of all control technologies that are available for reducing pollution from a source. Because CCS is a demonstrated technology that achieves a high level of control of carbon dioxide, it is reasonable to expect that a GHG BACT analysis for certain types of sources (such as LNG sources) would consider CCS as an available technology. To disregard an available technology, such as CCS, in the BACT review process would be counter to the principles laid out in the CAA definition of BACT and in the historical policies of the EPA and other permitting authorities, and could jeopardize the defensibility of the final permit, if challenged.

4. As you know, the President's budget includes $25 million to fund CCS for natural gas projects. If one of these projects becomes operational, would that be sufficient for EPA to begin requiring CCS as part of the NSPS or the PSD permitting process? What is the goal of these efforts? Will EPA be working with DOE on these projects?

RESPONSE: As outlined in the proposed Carbon Pollution Standards for new fossil fuel-fired power plant, determining BSER involves consideration of a number of factors. The successful operation of a natural gas-fired power plant utilizing CCS would be considered in such a BSER determination, but it would not necessarily result in CCS being found to be BSER. Similarly, BACT determinations for PSD permitting are done on a case-by-case basis, and while the successful operation of a natural gas-fired power plant utilizing CCS would be considered in such an analysis, it would not necessarily result in CCS being required for each permitted facility of the same type.

5. Please identify all:

a. Post-combustion coal projects EPA has cited or is aware of.

RESPONSE: The EPA has primarily referenced and discussed the following projects: Searless Valley Mineral Soda Ash (Trona, CA); AES – Warrior Run (Cumberland, MD); AES – Shady Point (Panama, OK); AEP Mountaineer (New Haven, WV); Southern Company Plant Barry (Mobile, AL); SaskPower Boundary Dam (Estevan, SK, Canada); and NRG Petra Nova WA Parish Plant (Houston, TX). The EPA is also aware of the Ferrybridge capture project (West Yorkshire, UK).

b. Post-combustion natural gas projects EPA has cited or is aware of.

RESPONSE: The EPA is only aware of one natural gas power plant that has demonstrated post-combustion capture: the Bellingham NGCC Power Plant (Bellingham, MA).

c. Pre-combustion CCS projects currently capturing and storing C02 at coal power plants that EPA has cited or is aware of.

RESPONSE: The EPA is aware that the following gasification facilities are currently utilizing coal (or petcoke) and capturing and storing CO_2: Dakota Gasification Company Great Plains Synfuels (Beulah, ND) – utilizes lignite coal; Coffeyville Gasification Plant (Coffeyville, KS) – utilizes petcoke.

d. Pre-combustion CCS projects currently capturing and storing C02 at natural gas power plants that EPA has cited or is aware of.

RESPONSE: The EPA is unaware of any pre-combustion CCS projects at natural gas power plants that are capturing and storing CO_2.

e. CCS power plant projects proposed or under construction that EPA has cited or is aware of.

RESPONSE: The EPA has primarily discussed and cited the following power plants that are proposed or under construction that are designed to use CCS: SaskPower Boundary Dam (under construction; Estevan, SK, Canada) – post-combustion, coal-fired; NRG Petra Nova WA Parish (under construction; Houston, TX) – post-combustion, coal-fired; Southern Company Kemper County Energy Facility (under construction; Kemper County, MS) – pre-combustion, IGCC utilizing lignite; Summit Power Texas Clean Energy Project (planned, Odessa, TX) – pre-combustion, IGCC utilizing coal; Hydrogen Energy California (planned, Kern County, CA) – pre-combustion, IGCC utilizing coal and petcoke.

f. Other non-power generation CCS projects currently capturing and storing C02 at the same scale that would be required in the power generation context--at least 1,000,000 tons C02 per year. How long has any such project been continuously capturing, injecting, and monitoring at this scale? What legal and regulatory systems are any such projects operating under?

RESPONSE: The Dakota Gasification Company – Great Plains Synfuels facility in Beulah, ND has captured over 2,000, 000 tons/year on average since 2000. The captured CO_2 is transported via pipeline to the Weyburn oil fields in Canada for use in EOR operations and for CO_2 storage. The project has no legal or regulatory obligation to capture CO_2. Note also that the Coffeyville Gasification Plant (Coffeyville, KS) captures CO_2 at rates of > 1,000,000 tons per year and in 2013 began utilizing 650,000 tons/year for EOR/CO_2 storage.

The Honorable Joe Kennedy

1. It is my understanding that there are some industries, such as the chemical industry and The cement industry that can utilize C02 in their production process. It can also be used as a feedstock for algae and other alternative fuels. Technology already exists using C02 for enhanced oil recovery (EOR) purposes. C02 emissions pose an incredible risk to our environment and economy. Finding a beneficial way to utilize the C02 we are already emitting would accomplish multiple goals at the same time -protecting the environment and the economy while continuing to harness an all-of-the-above energy strategy. How does the proposed rule for carbon pollution standards from new power plants take into consideration and encourage the beneficial use of C02? Are there any activities beyond EOR, including those in conjunction with DOE, by the EPA to encourage the beneficial use and reuse of CO_2?

RESPONSE: The EPA agrees that there are types of CO_2 storage technologies other than geologic sequestration that are under development. In the proposed Carbon Pollution Standards for New Power Plants, the EPA sought comment on the use of CO_2 storage technologies other than geologic sequestration, and the EPA will review and consider the comments received on this issue.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Subcommittee on Environment
Subcommittee on Energy

Hearing Questions for the Record
The Honorable David Schweikert

Science of Capture and Storage: Understanding EPA's Carbon Rules

Mr. David Hawkins

1. The Natural Resources Defense Council (NRDC) proposed a plan in 2012 to reduce carbon emissions from power plants under section 111(d) of the Clean Air Act. NRDC's original analysis assumes large amounts of end-use energy efficiency are available at very low costs. This assumption made your proposal seem very inexpensive (zero cost in your updated analysis) because these cheap energy efficiency measures could be used for compliance. However, you did not assume these cheap energy efficiency measures would be adopted in your base case, meaning that consumers would choose to save money only if EPA adopted your proposal.

   a. Please explain why these affordable energy efficiency measures were not included in your base case since it would make sense for consumers to lower their electric bills regardless of carbon constraints?

      ANSWER:
      The literature on the subject of energy efficiency establishes beyond dispute that despite the economic benefits of investing in efficiency, there are numerous barriers that have resulted in very large under-investments. NRDC's Reference Case is based on the Energy Information Administration's reference case projection, which models future electricity demand if this pattern of under-investment continues. NRDC's policy proposal for Section 111(d) carbon rules explicitly urges that additional investments in efficiency be recognized as a compliance technique. Because energy efficiency investments would reduce compliance costs for the carbon pollution standard, the modeling analysis projects that investments in efficiency will be significantly larger with a standard for carbon pollution than without such a standard.

   b. Could you explain exactly how your proposal would cause consumers to adopt more energy efficiency measures?

      ANSWER:
      NRDC's proposal would incorporate part of the cost of carbon pollution into the selection of electricity resource choices, including the choice whether to invest in efficiency measures that reduce the amount of electricity that customers need to buy to provide the comfort, security, lighting, and convenience they want, or whether to invest in other, more costly alternatives to

meet the standard. Both electricity suppliers and customers would see greater value in energy efficiency projects and efficient products and appliances under such a system. More manufacturers and vendors would be incented to offer more efficient products and services. Distribution utilities would be encouraged to offer innovative approaches to financing efficiency projects and product purchases as a means of reducing the cost of providing power service that complies with the carbon pollution standard. Consumers would benefit by adopting more energy efficiency measures due to additional incentives and choices offered by utilities and vendors, and because it would lower their electricity bills, reduce damaging public health consequences, and help create sustainable jobs in their communities.

2. Has NRDC, an affiliated local chapter, or NRDC on behalf of a member, ever filed an objection to a CCS project in a state, federal, or agency proceeding? If so, please provide all relevant petitions and the current status of any such objection.

ANSWER:

NRDC is on record as supporting properly designed and located CCS projects as an important part of a climate protection portfolio. For example, in 2009 NRDC submitted comments (attached) to the Department of Energy stating our belief that "carbon capture and geologic sequestration of CO2 (CCS), correctly implemented, must be a component of the U.S. climate mitigation portfolio." We provided our views on criteria that should be considered in making awards of government financial support for such projects and discussed the merits of three projects in particular.

NRDC has raised objections to several projects that included CCS as a potential component of the project. In no case have we objected to any proposal to apply CCS systems as part of such projects. Rather, our objections covered a range of topics related to different economic, environmental, and public health impacts of such projects and in some cases, we objected to the failure of the permitting authority to require an enforceable obligation to employ CCS as a term in the project's permit.

The following is a list of what I believe to be a complete list of proposed "CCS projects" where NRDC has raised issues with or expressed objections to one or more aspects of the project (relevant NRDC submissions for each of these are attached):

FutureGen: NRDC filed comments urging that the proposed New Source Performance Standards for CO2 from electric generating units be taken into consideration at this stage.
Status: project is continuing through the permitting process

Leucadia Indiana Gasification: NRDC filed comments and a Clean Air Act Title V petition objecting to a number of deficiencies in the permit for the project.
Status: EPA has not yet acted on the petition.

Tenaska Taylorville: NRDC opposed state legislation that would have mandated purchases of syngas from this project. We opposed the legislation on numerous grounds, including the fact that it did not require use of CCS as an enforceable condition. NRDC also filed an appeal of the permit with US EPA's Environmental Appeals Board objecting to a number of deficiencies in the permit for the project.
Status: permit withdrawn and project developer announced it was not pursuing the project.

Ohio River Coal-to-Liquids Project (Baard Energy): NRDC challenged the permit for this project on numerous grounds. http://bit.ly/QCcrli. While the project developers suggested in promotional materials that the project might use CCS, the air permit did not require CCS as an enforceable permit provision. As a general matter NRDC opposes coal-to-liquids technology because it results in high CO2 life-cycle emissions, even if CCS were applied. Our view is that CCS should be pursued in applications where the product, such as electricity, does not contain carbon that would be subsequently released to the atmosphere.
Status: project has not proceeded.

3. As you know, 111(d) requirements must be based on a best system of emission reduction (BSER) and your proposal is based on an initial emission rate of 1,800 lb. CO2/MWh that declines over time, has NRDC developed any legal and/or technical analyses that show why this particular emissions rate, as well as even lower emission rates, are BSER? We would be interested in reviewing the analysis if you can share that with the Subcommittees.

   ANSWER:
   In NRDC has published an analysis (http://www.nrdc.org/air/pollution-standards/files/system-based-pollution-standards-IB.pdf) that sets forth the basis for our conclusion that in adopting emission guidelines for existing power plants under Section 111(d) of the Clean Air Act, EPA may lawfully consider the contribution of all actions that enable a reduction in emissions from the fossil-fuel generating units that are subject to the guidelines. These actions can include hardware and fuel changes to the generating unit as well as operational changes at the generating unit due to substitution of lower-carbon electricity resources, including lower-carbon fossil fuels, renewable electricity resources like wind and solar, nuclear generation, and demand-side efficiency measures. Incorporation of these compliance options enables a 111(d) structure that can be expressed as a statewide emission-intensity target for existing fossil-generating units. Such a target can be determined to be BSER if supporting analysis shows that it is technically feasible and economically reasonable, given the compliance options that EPA would accept in an approvable state plan. NRDC believes that the analyses we have published demonstrate that the targets we have examined, including the more ambitious ones we examined in our recent 2014 analysis update, meet those criteria and that EPA has authority to adopt guidelines that achieve at least that level of emission reduction. The 2014 analysis update, which captures current electricity generation prices and trends, presents five scenarios varying in stringency and energy efficiency investment and demonstrates the potential for even greater CO2 emission reductions from power plants than in our initial analysis. This analysis update is available at: http://www.nrdc.org/air/pollution-standards/files/pollution-standards-IB-update.pdf

4. NRDC's proposal appears to assume emissions trading within certain regions of the country.

   a. Do you believe all of those regions will establish emissions trading programs if EPA adopted your proposal? Why or why not?

ANSWER:
NRDC's policy proposal encourages regional, interstate compliance approaches. However, in order to be conservative in assessing projected compliance costs we did not include such interstate compliance approaches in our modeling analyses. Rather, the modeling is based on *intrastate* compliance approaches. NRDC expects that many states would adopt emissions trading programs, and that some states would choose to form agreements for emissions trading across their boundaries. Forming larger, interstate trading or averaging territories would reduce compliance costs compared to trading within the individual states. Thus, we believe that total compliance costs would be lower than the estimates we have published.

b. What would be the economic effects of your proposal if those regions did not establish the trading programs your analysis assumes?

ANSWER:
As mentioned above, our cost analyses were not based on an assumption that states would employ interstate trading systems in implementing the carbon pollution standard for existing power plants. However, our policy proposal would encourage such interstate approaches. If states do adopt such approaches, we expect the compliance costs would be lower than those reported in our analyses.

c. What length of time do you anticipate would be required to set up these regional trading programs?

ANSWER:
NRDC believes that EPA could approve state program submissions that authorize interstate compliance mechanisms. We believe there is ample time prior to the program's first compliance date to finalize any arrangements that may not be complete as of the initial plan approval.

d. Could states that hope to establish regional trading programs meet EPA's schedule without a model rule? If you believe a model rule is necessary, who should propose such a rule?

ANSWER:
States certainly have the capacity to pursue regional compliance approaches with or without one or more model rules. NRDC believes that model rules could be helpful in suggesting alternative ways to address frequently asked questions about such approaches. Such model rules could be developed by various State government organizations, by electric system governance organizations, by EPA, or by a collaborative effort involving these and other stakeholders.

e. Would it be accurate to describe NRDC's proposal as a cap-and-trade program? If not, could you explain briefly the major differences between your proposal and other cap-and-trade programs, especially for greenhouse gas emissions?

ANSWER:
It would not be accurate to describe NRDC's proposal as a "cap-and-trade" program. NRDC's proposal allows States to prepare plans that establish a statewide average emission rate for fossil generating units without limiting total tons of emissions from the sector. If a state chooses to use a cap on emissions from the power sector to achieve power sector reductions equivalent to that resulting from the proposed rate-based system, we believe EPA has the authority to approve such an approach but our proposal does not require an emission cap approach.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
Subcommittee on Environment
Subcommittee on Energy

Hearing Questions for the Record
The Honorable Joe Kennedy

Science of Capture and Storage: Understanding EPA's Carbon Rules

Mr. David Hawkins

1. It is my understanding that there are some industries, such as the chemical industry and the cement industry than can utilize CO_2 in their production process. It can also be used as a feedstock for algae and other alternative fuels. Technology already exists using CO_2 for enhanced oil recovery purposes. Wouldn't it make sense for the federal government to find a way for these industries to CO_2 from power plants? CO_2 emissions pose an incredible risk to our environment and economy. Finding a beneficial way to utilize the CO_2 we are already emitting would accomplish multiple goals at the same time – protecting the environment and the economy while continuing to harness an all-of-the-above energy strategy. What role can the government play in encouraging the beneficial use of CO_2 in addition to geologic sequestration? And how would you characterize the feasibility of these technologies to reuse rather than sequester CO_2?

ANSWER:

Maximum reductions in carbon pollution can be achieved only when captured CO2 is used in in applications where there would be no subsequent release of that CO2 to the atmosphere. Disposal of captured CO2 in properly sited, designed, and operated geologic repositories meets that criterion. Research is continuing on various concepts that would bind CO2 into chemicals or building materials in a manner that would permanently isolate the CO2 from the atmosphere. However, the viability of such approaches has not been demonstrated to date.

As discussed below, use of CO2 in Enhanced Oil Recovery (EOR) projects could meet the permanent retention criterion if such EOR projects were properly sited, designed, and operated. Current regulations do not require EOR operators that inject CO2 to meet such requirements.

Using captured CO2 to produce algae or alternative fuels can be viewed as a technique for potentially reducing the carbon intensity of an activity compared to current practice. But if the carbon in the fuel is released to the atmosphere upon combustion (as would be the case for transport fuels, for example) then there would be no net CO2 emission reduction from the process unless it were displacing some other more carbon-intensive fuel. At present, such approaches do not appear to have the potential for achieving reductions in CO2 emissions nearly as large as geologic sequestration approaches and some fuel conversion approaches, such as coal to liquids, would increase cumulative CO2 emissions.

Finally, there are applications where the captured CO2 is directly re-released to the atmosphere

with little or no benefit to the environment. The clearest example is CO2 use in the beverage industry, where all the CO2 used in bottling is released to the atmosphere as soon as the beverage is opened and consumed.

Regardless of the type of application, if the process requires energy input, it is important to also consider the CO2 generated by that energy production to determine if the process results in a net CO2 reduction.

Properly operated and regulated EOR operations could provide a permanent repository for captured CO2. However, an important aspect of this process is that it enables production of additional oil from a given field and combustion of that oil will itself result in CO2 releases. In the near term, it is likely that oil produced in a given EOR field will displace production from some other field, resulting in no net annual increase in CO2 from current oil use. But over the long term, it is likely that large amounts of EOR-produced oil could result in an increase in total cumulative emissions. To prevent this, society will need policies that effectively limit total cumulative CO2 emissions to levels that are compatible with a safe and hospitable climate. NRDC supports CO2-EOR in properly sited, designed, and operated projects as a component of a broader strategy to limit total cumulative CO2 emissions.

To provide greater assurance that CO2 injected for EOR projects is in fact permanently retained below ground, EPA and state agencies should require demonstrations that the oil fields do not contain leakage pathways (such as degraded wells, or faults and fractures that could provide an escape pathway to the surface) and require appropriate monitoring and reporting to document the fate of injected CO2.

Government has an important role to play in encouraging the beneficial use of CO2. One such role is to fund and conduct basic research and development on CO2 utilization technologies and processes. The U.S. Department of Energy, in partnership with universities, research institutions, and private corporations, is actively pursuing research on CO2 utilization applications, with the four main focus areas being cement, polycarbonate plastics, mineralization, and enhanced hydrocarbon recovery.

NRDC believes that as the US and other countries adopt serious standards to limit CO2 emissions, the commercial interest in developing systems that can use CO2 and achieve large net emission reductions will increase. Before such approaches are demonstrated and deployed, current opportunities to inject CO2 for EOR and into dedicated geologic storage formations provide an ample resource to isolate all CO2 captured from new power plants and other large emission sources.

YORK STENOGRAPHIC SERVICES, INC.

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SCIENCE OF CAPTURE AND STORAGE: UNDERSTANDING EPA'S CARBON RULES

Wednesday, March 12, 2014

House of Representatives,

Subcommittee on Environment

joint with the

Subcommittee on Energy

Committee on Science, Space, and Technology

Washington, D.C.

The Subcommittees met, pursuant to call, at 10:07 a.m., in Room 2318 of the Rayburn House Office Building, Hon. David Schweikert [Chairman of the Subcommittee on Environment] presiding.

Chairman SCHWEIKERT. The joint hearing of the Subcommittee on Environment and the Subcommittee on Energy will come to order, and there is the gavel.

I want to thank everyone for joining us today. Welcome to today's joint hearing titled ''Science of Capture and Storage: Understanding EPA's Carbon Rules.''

In front of each member are packets containing the written testimony, biographies and Truth in Testimony disclosures for today's witnesses.

Before we get started, since this is a joint hearing involving two subcommittees, I want to explain how we will operate procedurally to all the members and understand how the question-and-answer periods are going to work. After recognition of the Chair, ranking members of the Environment and Energy Committee, we will recognize those members present at the gavel in order of seniority on the--joint or full Committee? Okay. It probably should be--well, we will go with the full Committee because that is how we wrote it before. And those coming in after the gavel will be recognized in order of arrival.

Let me recognize myself for just a couple minutes as sort of for an opening statement. And I always drive staff a little nuts when I do this. I am going to go somewhat off script. I spent the last 2 days trying to read everything I get my hands on, the individual testimonies, data and

information provided from the EPA and other just random articles. Fascinating subject area.

But my fear is--let us see if I can find an elegant way to express this--is sort of the law of unintended consequences. So as we are having the weaving of the discussion, what I would love woven into that discussion is the underlying technology, the underlying science. And symbolically, let us see if I can make this make sense. At home in my desk, I have the first-generation iridium phone--many of you remember that--will a little plaque on it saying just because you can engineer it, doesn't mean you should do it. That actually sort of weaves through this. We have much of the scientific capability, at least theoretically, but have we stressed it? Do we truly understand the unintended consequences? Do we also understand what carbon sequestration, or ACO2, as it is often referred to in the literature, where we would be 50 years from now, 100 years from now, even after some of those capturing facilities have been shuttered? Where are we truly technology-wise? And then also then the weaving of the discussion of the proposed rule sets and are those rule sets appropriate, robust, and what is the cost curve on those for adoption, you know, have we made the cost curve something where now it is a theoretical discussion that we have now actually priced out of practice.

[The statement of Mr. Schweikert follows:]

********** INSERT 1 **********

Chairman SCHWEIKERT. So with that as an opening statement, I will turn to my ranking member, Ms. Bonamici, for her opening statement.

Ms. BONAMICI. Thank you very much, Mr. Chairman, and thanks to the Chair of the Energy Subcommittee--I know Ms. Lummis is on her way--for holding this morning's hearing.

Today we are going to be discussing the performance standards proposed by the Environmental Protection Agency --EPA--for carbon dioxide emitted from new power plants. This is a hearing that is similar to one we held last fall, but this time we have the opportunity to hear directly from EPA about this important issue, and I would like to thank Acting Administrator Janet McCabe for being here today and I would also like to thank the witnesses on our first panel for their thoughtful testimony, which I have reviewed.

Last year, President Obama laid out an agenda to address one of the biggest environmental challenges of our time: climate change. A key component of that plan, and any effort to reduce the amount of carbon emitted by the United States, is the need to significantly lower the amount of carbon produced during electricity generation. Emissions from power plants represent about a third of the greenhouse gases produced by the United States, and EPA's proposed rule takes an important first step in tackling this major source of carbon pollution.

To emphasize: the proposed rule sets carbon limits on new power plants, not existing plants or those under construction. Looking at current and future market conditions, especially competitive natural gas prices, it is likely that many if not most new power plants will be able to meet the proposed carbon limits. It is the market, not the proposed rule, that is contributing to the proliferation of natural gas power plants over coal. In my home State of Oregon, our last coal plant is scheduled to be closed by 2020, and some of that generation capacity will be replaced with a natural gas plant.

The proposed EPA rule will create a market incentive for the continued development and promotion of carbon capture and storage, or CCS, technologies. The advancement of CCS technologies is essential if new coal power plants are to operate in the low-carbon future we must achieve.

I also want to point out that when EPA determines the best system of emission reduction, it is actually required to promote the development of technology. I am sure we will hear much more on the state of CCS technologies from today's witnesses. That technology development is good for the economy and good for the earth.

Last week, we debated the EPA's proposed carbon limits on the House Floor. Some called into question whether CCS was adequately demonstrated because the technology is not

commercially available. There is a difference between the two. The legal requirement is ''adequately demonstrated,'' and the EPA has met that burden.

Let me close by saying that I know many of my colleagues across the aisle are skeptical about whether humans contribute to climate change. But the scientists, overwhelmingly, are not. And my constituents are not, and indeed they are seeing the impacts of climate change and asking policymakers to act. This winter's reduced snowpack not only means a shorter ski season and less of an economic boost from tourism, but it means less water for agriculture and salmon migration this spring and summer. The acidity of the Pacific Ocean is increasing, putting Oregon's fisheries and shellfish industries at risk. Warmer temperatures are leading to increased outbreaks of the mountain pine beetle, harming the Northwest's forest industry. And warmer temperatures are making it more challenging to grow our region's famous Pinot Noir grapes, a big part of the economy in Oregon.

So the impacts are real and we must do all that we can to mitigate the effects of climate change. The carbon dioxide we release now will affect generations to come. I am supportive of the Administration's efforts to transition the United States to a lower-carbon economy, and the EPA's proposed rule for new power plants is a critical step in that

direction.

Thank you. I yield back, Mr. Chairman.

[The statement of Ms. Bonamici follows:]

********** INSERT 2 **********

Chairman SCHWEIKERT. Thank you, Ms. Bonamici.

Mr. Swalwell.

Mr. SWALWELL. Thank you, Chair, and thank you for holding this hearing today, and I agree with my colleague, Ms. Bonamici: global climate change is one of the greatest challenges of our time, and last September the Intergovernmental Panel on Climate Change released a report which states with 95 percent certainty that human activities are indeed responsible for climate change, and this report was based on a rigorous review of thousands of scientific papers published by over 800 of the world's top scientists. And this report also makes it clear that if we don't take steps now, if we don't take steps today to halt what is causing climate change, the repercussions for humans and the environment will be catastrophic.

And the problem, as I see it, is that right now too few recognize that this is happening. I was giving a college lecture just 2 nights ago, and a student asked me, well, isn't it that Republicans think climate change isn't happening and Democrats think climate change is happening and it is caused by mankind, and I told the student, I look at this as I would look at my cases when I was a prosecutor, and as a prosecutor, if I was proving a homicide and I had DNA evidence, I wouldn't sit in a witness chair and testify, I would call an expert DNA analyst to the witness chair and

that expert, based on that expert's training and experience and education, would tell the jury that indeed the DNA evidence was present and relevant, he is qualified as an expert. And here as I look at it with climate change, it is no different. We have called in the experts, and the experts are Republican scientists and the experts are Democratic scientists, and they have reached a bipartisan, nonpartisan, actually, conclusion, which is that humans are affecting climate change, and I think the sooner we all agree on that, the sooner we all sing off of the same sheet of music, the better off we will be and the better suited we will be to address what we can actually do to reduce its impact.

And so I have repeatedly said on this Committee that I am for an all-of-the-above approach to energy production as we transition to clean energy technologies, but I have also made it clear that this all-of-the-above approach we must make sure that we are taking steps to reduce our greenhouse gas emissions and lessening their impact on human health, the environment, and global climate.

And so I want reinforce also that the proposed standards going forward are only for new plants that may be built and are not intended and will have no effect on existing plants, so we are not going to see a wave of shuttered plants and massive layoffs as a result of their implementation. So again, I want to repeat this for folks in the coal industry

who rightfully may be fearful of what this means. These regulations from the EPA are for future plants, not for existing plants. And there are in-depth discussions underway right now about establishing standards for existing plants, which the EPA currently plans to produce in June, but there is an ongoing, extensive engagement with all the stakeholders to make sure that those standards will be flexible and won't have negative effects on state economies and job creation.

So my colleagues on the other side of the aisle often talk, and I think for good reason, about not wanting to saddle our children with our national debt, and for that same reason, that same principle, I think we want to make sure that we do not saddle our children with the effects of climate change. So I am interested in what this hearing produces and what our witnesses have to say about carbon sequestration and what we can do to address climate change.

And with that, I yield back.

[The statement of Mr. Swalwell follows:]

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Chairman SCHWEIKERT. Thank you, Eric--I mean, excuse me, Mr. Chairman--or excuse me, Ranking Member, and let us hope it stays that way.

Chairwoman Lummis.

Mrs. LUMMIS. I want to congratulate you on your new position on the Committee, and I look forward to working with you through the rest of this year. Our Environment and Energy Subcommittee joint hearings should be interesting, and I am happy to have you on board.

Last fall, the Science Committee held a similar hearing on the status of technology for carbon capture and storage. It was confirmed that CCS is not operating in any commercial-scale power plant in the United States and thus should not be considered adequately demonstrated technology under EPA's New Source Performance Standards.

Today we will also discuss the transportation and storage of captured carbon and what viable solutions currently exist for industry. I look forward to the hearing and hearing from EPA witness as well on the storage options under the proposed NSPS. Is recycling carbon in enhanced oil recovery possible on a large scale or will untested long-term geological sequestration be needed?

The EPA has implied that the rule does not need to speak to the issue of sequestration, that the cost and feasibly of carbon storage is outside the scope of their rulemaking.

Staying silent on the last steps of the process proves the lack of demonstrated commercial viability.

Instead of focusing on real solutions, the EPA assumes this proposed rule will result in negligible CO2 emissions changes, quantified benefits, and costs by 2022. Since it effectively bans the building of new coal plants, it has no impact.

The EPA is ignoring the consequences of their rulemaking to instead set a legal precedent for mandating unproven technologies. They need to go back and assess the impacts of this rule on non-air issues. There is no science behind the de facto mandated storage requirement. This is a policy of picking winners and losers through environmental regulations. New natural gas-fired units, boilers and heaters and existing plant standards are next. We need to see an all-of-the-above energy policy, not one based purely on politics.

I look forward to hearing from this first panel of witnesses on the larger effects of this rulemaking to the energy supply chain from research to delivery. Thank you for joining us.

I might also comment that in my State of Wyoming, in Gillette, Wyoming, the Neil Simpson coal-fired power unit will be shut down on March 21st, just in about 10 days. That is a unit that is only shutting down because of EPA regulations on industrial boiler MACT. The maximum

obtainable control technologies don't exist to allow that boiler to continue through its remaining useful life of 10 years, so it is going to be shut down. They are going to run it right up until the day that the EPA rules take effect because it is the most economical way to deliver affordable energy to the consumers it serves. It will be replaced by something more expensive. So rather than allowing it to continue through its useful economic life, it is being retired. It will be disassembled. It will be moved to another country. It will be reassembled and burn in another country. This is not sound policy.

So I am looking forward to hearing what sound policy that we can derive as a result of EPA's work.

Thank you, Mr. Chairman, and thank you, panel, for joining us.

[The statement of Mrs. Lummis follows:]

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Chairman SCHWEIKERT. Thank you, Chairwoman Lummis.

If any of the members wish to submit additional opening statements, your statements will be added to the record at this point, and I believe you can do that for--in this Committee, it is 7 days? Or 2 weeks, to be able to add an opening statement.

[The statement of Ms. Johnson follows:]

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Chairman SCHWEIKERT. Having read all of your statements, you are all very, very bright and you are very smart. I will beg of you as we go through this hearing, I see this is a technical hearing, help us raise our level of technical understanding of this technology. And so instead of--it is less policy, it is more math and science, shall we say.

Our first witness is David Hawkins, Director of Climate Change Programs at the Natural Resource Defense Council. He joined NRDC in 1971 as one of the organizers' first staff members. In 1977, Mr. Hawkins was appointed to be the Assistant Administrator for Air, Noise and Radiation at EPA under the Carter Administration. In 1981, he returned to NRDC's Air and Energy Program, and in 2000 became director for NRDC's Climate Center. Today's--okay. Instead of introducing everyone at once, I thought we will introduce each person as they get ready.

Mr. Hawkins, 5 minutes. And you know the routine: yellow light; talk faster.

STATEMENTS OF DAVID HAWKINS, DIRECTOR OF CLIMATE CHANGE PROGRAMS, NATURAL RESOURCES DEFENSE COUNCIL; ROBERT G. HILTON, VICE PRESIDENT, POWER TECHNOLOGIES FOR GOVERNMENT AFFAIRS, ALSTOM POWER INC.; ROBERT C. TRAUTZ, SENIOR TECHNICAL LEADER, ELECTRIC POWER RESEARCH INSTITUTE; AND SCOTT MILLER, GENERAL MANAGER, CITY UTILITIES OF SPRINGFIELD, MISSOURI, AMERICAN PUBLIC POWER ASSOCIATION

STATEMENT OF DAVID HAWKINS

Mr. HAWKINS. Thank you very much for inviting me to testify on behalf of NRDC. Several points I would like to make.

First, as numerous scientific and industrial organizations have concluded, we have to act with urgency to bring low-carbon electricity resources to market. We can't protect the climate without them.

Second, the Clean Air Act, passed by a bipartisan vote and signed by President Nixon, calls on EPA to set standards for pollutants like CO2 that present a danger to health and welfare. Now, Congress did not give EPA free rein in setting these standards but it did not tie EPA's hands either.

The Act sets sensible limits on EPA's authority for these standards. First, EPA must show that the technology is available that could be applied to meet the proposed

standards, and second, it must show that the cost of meeting those standards is reasonable. The EPA proposal is on solid ground legally and technically in the standards for new coal plants that it has proposed based on the capability of carbon capture and storage, or CCS, because in writing the Act, you did not require that EPA must point to a technology that is already in use in the regulated industry. To have done so would have been to put the polluters in charge of deciding whether they would ever have to clean up. Instead, the law directs EPA to survey approaches that can work in a given sector, even if there is little or no current use of those approaches in the category that is being regulated, and that is a commonsense approach.

As my testimony details, carbon capture and storage is proven technology at industrial scale with decades of experience for each of the component processes. Even without a standard in place, there are several vendors who are already offering commercial carbon capture systems and pipeline transport and geologic storage of CO2 is fully commercial. EPA in its record has established a substantial body of evidence to support its technology conclusions, and the courts will review those conclusions when they consider challenges to the rule.

Turning to costs, EPA conducted a comprehensive analysis using Department of Energy research and concluded that the

cost of making electricity at a new coal plant with CCS would fall in the range of the costs for new nuclear or biomass energy plants. Now, compared to production costs of a new coal plant with CCS to a new coal plant without CCS, the costs of the plant with CCS as EPA found would be about 20 percent higher, and that is without considering any revenues for enhanced oil recovery. But customer rate impacts would be much less than 20 percent, and that is because the cost of any given single unit is diluted by being folded into the rate base for that system.

Now, some in the coal industry and some owners of coal plants are lobbying Congress to intervene and try to block EPA's standards. This would be profoundly bad policy. If we prevent EPA from setting sound standards, that will not allow us to escape the threat of climate disruption. That will continue no matter what laws Congress tries to enact. Instead, it would perpetuate uncertainty about what investments should be made in the power sector. Investors who are asked to commit billions of dollars to a new power plant will not believe that a Congressional bar on action by EPA, in the very unlikely event that such legislation were signed into law, will be a stable basis for making those billions of dollars of investments. New coal plants take 10 years to build and another 15 or 20 years to earn their investment back in the best of times, and if you believe that

there are investors out there that are willing to take the risk that no limits on carbon pollution will be forthcoming during that long period of time, I suggest you hold another hearing and invite them to testify.

My advice to Members of Congress who are genuinely interested in creating space for coal to play a continuing role in the American economy would be to reject these efforts to hamstring EPA and instead support efforts that could enjoy bipartisan support to provide financial incentives for CCS used for enhanced oil recovery, for example. NRDC is on record supporting those kinds of initiatives, and we would be happy to work with Members that are interested in pursuing that approach to this important problem.

Thank you very much.

[The statement of Mr. Hawkins follows:]

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Chairman SCHWEIKERT. Thank you for that.

Today's second witness is Mr. Robert Hilton, Vice President of Power Technologies for Government Affairs at Alstom Power, Inc. Mr. Hilton has been in the air pollution control field for over 30 years. In his current role, Mr. Hilton provides information and technical data on power technology to State and federal regulators. He holds 15 U.S. and foreign patents and has authored numerous technical publications.

Mr. Hilton, 5 minutes.

STATEMENT OF ROBERT HILTON

Mr. HILTON. Good morning. I would like to thank the chairman and the chairwoman and the ranking member the opportunity to present this testimony.

Alstom is a global leader in the world of power generation, transmission and transportation infrastructure. We are a leader in the field of carbon capture, having completed work on four pilots and 10 pilot, validation and commercial-scale plants that are in operation, design and construction. These projects include both coal and gas.

It is critical to be at commercial scale to define the risk of offering the technology. This will define contractual conditions and standard commercial terms including multiple performance guarantees, reliability, availability and other contractual guarantees.

Finally, our customers would be reluctant to invest in carbon capture technologies that have not been demonstrated at full commercial scale. Based on these criteria, Alstom does not currently deem its technologies commercial, and to my knowledge, no one else is willing to offer this full suite of guarantees. I emphasize, however, that the technologies being developed by Alstom and others work.

Let us take a look at the Clean Air Act criteria for best system of emission reduction. As proposed by EPA,

feasibility, looking at the projects they cited, Kemper is under construction and not demonstrated. Sask is under construction and not demonstrated. Summit, HECA, Parrish haven't even started construction. AEP Mountaineer was only 2.3 percent of the plant gas stream and does not qualify as significant. Dakota Gasification is producer of natural gas and fertilizer plant and not a power plant. Four of the six projects are gasifiers and high-pressure technology not suited to pulverized coal or natural gas combined cycle plants, which are atmospheric pressure, which really represent 95 percent or more of the fleet. These atmospheric technologies are not operating at significant scale at any site.

Cost--Alstom cannot comment in detail on the status of projects proposed by other companies, but based on facts in the public domain, I am aware of no CCS projects that would be considered cost-competitive in today's energy economy. The five capture and sequestration projects cited in NSPS proposal all rely on either EOR or byproduct revenues and/or federal subsidies. EPA should consider the typical power plant, which will not have federal subsidies and will not likely have access to chemical and EOR revenues. EPA needs to recognize that both chemicals and EOR are niche opportunities.

Then next comes the size of CO2 reductions. EPA admits

in its rule that it will not achieve significant reductions; in fact, it will simply slow the rate of acceleration.

As far as technology goes, this regulation will essentially stop the development of CCS since the proposed regulation provides a significantly lower cost alternative, natural gas, to the application of CCS on coal. There is unlikely to be a market for at least 10 years. Industry-based R&D based on return on investment will stop. One only needs to look at the slowing pace already reported by the GCCSI.

We differ with EPA on the notion that NSP regulations will spur development. Let us really look at the industry has done for the Clean Air Act. When they wanted to do particulate matter, the EPA had been--rather, industry had been doing precipitators and collectors since the 1920s. When they went to do sulfur dioxide, the first full-scale scrubbers were built in 1942. I personally worked on one in 1970. When the NOX SIP call came in 1999, we had been doing reduction technologies since the 1980s. When mercury came in 2010, the industry had been deploying these since the mid-1980s, and in this case, we actually worked with EPA to revise the rule.

NSPS is different. The issue we are now faced with is that industry did not in earnest begin work on CO2 from atmospheric gases until the early 2000s. The technology is

not fully developed and the regulation proposed is ahead of the technology. It should be noted that this is a larger, more complex and technically sophisticated technology compared to any of the others in the Clean Air Act.

With no new power generation being built, it is our view that this presents a real threat to the U.S. economy both in terms of employment and the industries that build and supply coal plants as well as the mining, transportation and maintaining the necessary technology leadership. The true state of the technology on conventional power plants is that today there have been a handful of small demos such as AEP's Mountaineer and Southern Company's Plant Barry on coal. There are two small pilots in Mongstad, Norway, on gas. EPA indicates it has done literature searches and reviews of other sources of information to determine all the components are available. However, an important point that EPA misses is that the true risk and the complex multistage process is in the integration of all of the processes.

Let me make just a couple of quick points on that. How does the capture process respond with generation load? How does it respond when it is slaved to the unit? There are others that I could go on and on technically. I also would point out that DOE has developed a comprehensive roadmap and timeline for the commercialization of CCS technologies, which points to general deployment in the 2020s. We would

encourage EPA to look at that.

Finally, it is the issue of cost, and we do not believe in this market and our experience shows us that the public utility commissions, the regulators are trying to maintain lowest cost of electricity to ratepayers. It is highly unlikely that they are going to approve the development and/or deployment of CCS with coal when they can do it much cheaper with a natural gas plant.

Thank you.

[The statement of Mr. Hilton follows:]

********** INSERT 7 **********

Chairman SCHWEIKERT. Thank you, Mr. Hilton.

Our third witness is Mr. Robert Trautz, Senior Technical Leader at the Electrical Power Research Institute. He has over 30 years of experience in research and applied geology and hydrology involving CO2 storage. In his current capacity, Mr. Trautz manages demonstration projects funded by the Department of Energy, EPRI and other industry groups. Mr. Trautz has previously worked at Lawrence Baker National Laboratory and the U.S. Geological Survey.

Today's--Mr. Trautz, 5 minutes.

STATEMENT OF ROBERT C. TRAUTZ

Mr. TRAUTZ. Thank you very much, Mr. Chairman.

My name is Robert C. Trautz. I am a Senior Technical Leader at the Electric Power Research Institute. EPRI conducts research related to the generation, delivery and use of electricity for the benefit of the public. EPRI is working with the Southern States Energy Board within the Southeast Regional Carbon Sequestration Partnership program to assess CO2 storage opportunities in the southeastern United States. My testimony reflects the independent views of EPRI and isn't defined by SSEB or SECARB.

At the heart of the proposed New Source Performance Standard is a mandatory reduction in CO2 emission intensity using CCS technology that will require coal-fired power units to reduce CO2 emissions to less than 1,100 pounds per megawatt-hour gross. To place EPA's emission limit in perspective, the amount of CO2 that will need to be stored to meet the limit is approximately 40 percent of the CO2 output from a pulverized-coal plant. For a moderate-sized, 1,000-megawatt plant, this equates to about 3.1 million tons per year. Over a 40-year lifespan, for this example, the plant will need to store over 120 million metric tons of CO2.

To understand the significance of storing this quantity of CO2, I offer the following storage example for

illustrative purposes only. Using the Lower Tuscaloosa Sandstone located within the Gulf Coast region of the United States, injection of 120 million tons of CO2 into this regionally extensive saline reservoir would create a CO2 plume with a subsurface area of several square miles. This example illustrates the importance of characterizing and utilizing large regional reservoirs for CO2 storage due to the very large quantities of CO2 that we are talking about for multiple plants.

The U.S. Department of Energy estimates there are approximately 226 billion metric tons of CO2 storage capacity in depleted oil and gas reservoirs and up to 20 billion metric tons in saline formations in the United States and Canada. The stark contrast in these storage estimates reflects the widespread distribution and importance of saline reservoirs. The potential use of depleted oil and gas reservoirs for CO2 storage could be adversely affected by potential regulatory requirements associated with CO2 storage. Preliminary feedback from oil producers indicates that a requirement for EOR operators to monitor and certify CO2 storage under subpart RR of the EPA's mandatory reporting, greenhouse gas reporting requirements could be a risk that many companies may not be willing to take. Thus, such requirements may have the unintended consequence of discouraging the use of depleted oil and gas reservoirs. The

limited geographic distribution and storage capacity of these reservoirs in any case will eventually limit their long-term use. One of the benefits of using depleted oil and gas reservoirs for CO2 storage is the wealth of geologic knowledge available for these reservoirs. In contrast, little is known about saline reservoirs because they currently have little to no economic value. To date, there are only three large-scale saline storage projects in the world that have or are currently injecting CO2 at a rate approaching 1 million metric tons per year. It is important to note that these projects involve CO2 separation from natural gas and store an annual amount equal to about a third of the CO2 from a single 1,000-megawatt power plant. From a geologic storage perspective, these projects are very important for the following reasons.

The Sleipner Project in the North Sea is the flagship of the global CO2 saline storage project injecting CO2 at a sustained rate of 1 million metric tons per year for nearly 20 years. The Snohvit Project in the Barents Sea is injecting at a rate of 820,000 metric tons per year. Initially, however, this project found that the formation permeability was too low and pressures climbed rapidly, requiring injection into a different zone. The In Salah Project in central Algeria suspended CO2 injection in 2011 after monitoring data indicated that the lower caprock above

the storage reservoir had likely fractured due to injection.

The projects illustrate the risks and geologic uncertainty associated with selecting a saline storage site. They also illustrate the need to gain experience at scales commensurate with full-scale commercial power projects. The DOE's field demonstration projects are invaluable because of their ever-increasing storage scale. However, given that the NSPS is clearly focused on reducing emissions from fossil fuel-fired plants, further government investment in research is needed that integrates power projects with capture and saline storage at full scale. Only two of the DOE demonstration projects fielded to date have included small-scale capture and saline storage on coal-fired units of less than 100,000 tons each, and only one large-scale, million-ton-per-year saline injection project is currently planned.

In addition, given that more is known about oil and natural gas reservoirs, future storage research and funding may need to focus more on saline reservoirs to help close the knowledge gap.

Thank you for the opportunity to testify before you today, and I welcome your questions.

[The statement of Mr. Trautz follows:]

********** INSERT 8 **********

Chairman SCHWEIKERT. Our fourth witness today is Scott Miller, General Manager and CEO of City Utilities of Springfield, Missouri, a member of the American Public Power Association. Mr. Miller joined the City Utilities in 2002 as the Associate General Manager for Electrical Supply and was named General Manager and CEO in 2011. Mr. Miller also serves on the board of directors of the American Public Power Association and the Missouri Joint Municipal Electric Utility Commission. He has 27 years of experience in the utility industry.

Mr. Miller, 5 minutes.

STATEMENT OF SCOTT MILLER

Mr. MILLER. Thank you, Mr. Chair.

I have been in the industry 27 years. I represent City Utilities of Springfield. We are a municipal utility. We offer electric, natural gas, water, broadband and transit services to the Springfield area. We have over 1,100 megawatts of generation and we serve over 220,000 customers. I am also a member of the board of directors at APPA, and we represent the interests of over 2,000 community-owned utilities, not-for-profit utilities, that provide services to over 47 million Americans. We provide locally controlled, low-cost, reliable, efficient and environmentally responsible energy.

The public power utilities are concerned about the potential for likely impacts the EPA regulating greenhouse gas emissions from new power plants by establishing New Source Performance standards under the Clean Air Act. In particular, public power utilities strongly disagree with EPA's conclusion that carbon capture and storage is the best system of emission reduction, or BSER, for reducing CO2 emissions. The conclusion is premature, given that there are no commercially operating coal plants using this technology, and the agency's failure to address the variety of regulatory hurdles that are impeding sequestration and CO2 in the United

States.

City Utilities was recently involved with a carbon sequestration project within our state. Our experience highlights some of the issues that would be addressed before CCS could be deemed as adequately demonstrated. In 2005, we got together with the generating utilities across the state to determine what were we going to do if carbon emissions were regulated. At the time, over 70 percent of our generation came from coal-fired generation. Much of the research that we had seen did not address shallow sequestration issues that we would have had for geologic formations within our state. In 2008, City Utilities received $4.7 million of federal funding administered through DOE so that we could do the Missouri Shallow Carbon Sequestration Project. City Utilities with Kansas City Power and Light, the Empire District Electric, Ameren Missouri, and Associated Electric Cooperative also matched funds of $1.2 million, so we had our customers' money involved with the project. The project's purpose was to evaluate the feasibility of onsite sequestration at the power plants. The project targeted sandstone formations that were approximately 2,000 to 3,500 feet, which mean that we would be injecting in a gas phase as opposed to the liquid or supercritical phase. The original plan targeted saline aquifers, which we just heard about, and small injections of food-grade CO2 to see

how that would be encapsulated within the formation. Our research was conducted by Missouri State University, Missouri University of Science and Technology, and our DNR within the state.

The John Twitty Energy Center at City Utilities was the primary site. The drilling was conducted and we reached the Precambrian level at about 2,200 feet, but we were not allowed to inject because what we found was the water quality in that area was potable. We were expecting saline and it was potable water. So federal regulations stopped us from injecting at that point. We had to change our project, and we decided to go to other sites within the state in the northwest, north central and near the St. Louis area so that we could determine if they were actually saline aquifers in a shallow formation within our state.

In summary, we spent about $5.8 million for the testing. We found one area of the state that has now been eliminated because of the quality of the water. We have two others that we have identified in the state that we believe are acceptable, and we were also able to identify three areas where the confining layer looked to be a positive where it would confine the CO2 within the aquifer. However, we were not allowed or were not complete our pressure testing or aquifer permeability because of cost limitations, so we were not able to substantiate through CO2 injections that we had

the ability for long-term storage within our state.

Based upon the results of this project and others that we have seen across the United States and across the world, CCS technology is not really a realistic option for utilities seeking to reduce their CO2 emissions in the near future. As a CEO of a municipal utility, one of my responsibilities is to our city and our customers, that if we are going to spend their money, we need to know that it is going to go towards something that will function for them, and we do not have a high degree of confidence that CCS will do that for us.

In looking at all the CCS research that is out there, it appears there is no factual basis that EPA may assert that carbon sequestration technology has met the Clean Air Act's three-part test, which is the technology needs to be adequately demonstrated, it needs to be widely available and it needs to be shown to be technically and economically feasible, and we don't believe that that is out there.

Thank you.

[The statement of Mr. Miller follows:]

********** INSERT 9 **********

Chairman SCHWEIKERT. Thank you, Mr. Miller.

As all of you know, your written testimonies are being made now part of the record. I am going to turn to Chairwoman Lummis for the first 5 minutes of questions.

Mrs. LUMMIS. Thank you, Mr. Chairman.

First, I would like to ask all of our panelists for a show of hands, how many of you live on $1,226 a month right now? The record reflects that none of you raised your hands.

Let me tell you about this woman who was written about in the day before yesterday's New York Times, and Mr. Chairman, I would like to without objection submit the New York Times article ''Coal to the Rescue but Maybe Not Next Winter'' to the record.

Chairman SCHWEIKERT. Any objections on either of those? None heard.

Mrs. LUMMIS. Thank you.

[The information follows:]

********** INSERT 11 **********

Mrs. LUMMIS. Well, let me tell you about this article. This woman had on her $1,200-a-month income her utility bills go up $100 just in one month. This article by Matthew L. Wald states that ''At the end of the harshest winter in recent memory, the bill is coming due for millions of consumers who are not only using more electricity and natural gas but also paying more for whatever they use, and there might not be relief in future winters as the coal-fired power plants that utilities have relied on to meet the surge in demand are shuttered for environmental reasons.''

Question, Mr. Miller. If the Nation's existing coal capacity cannot be replaced due to EPA's proposed New Source Performance Standards rule, where will you turn for new generation?

Mr. MILLER. We don't have a lot of options. I mean, coal is a foundation within our state. We would have to look to natural gas and we would have to look to purchases on the market, which would rely on mostly natural gas generation that would be coming online. The issue that we saw this winter is that we don't have the infrastructure for the natural gas for power generation at the same time that we are trying to make sure that people's homes stay warm. So when you have those in competition recently during the cold spell, we had to curtail our natural gas generation so that we had enough gas for people to heat their homes. So obviously it

has a huge impact, and we have seen that push the price of natural gas up. So in general, I am not sure we have the natural gas infrastructure to support the transition from coal to other generation that is out there, and we have the same issue that you have--that was in that article. We have 22 percent of our customers that are living at the poverty level, so any time that you have additional costs implied through regulations, it goes right to their bottom line, and they are trying to figure out how to pay their bills.

Mrs. LUMMIS. Thank you.

Mr. Trautz, your testimony states that the new subpart RR requirements in the proposed rule could be a risk that EOR companies are not willing to accept. Where does this leave a power provider looking to invest in coal or natural gas if the EPA decides to require CCS for gas?

Mr. TRAUTZ. So for--the only thing that they would probably turn to is to saline reservoirs because those are broadly distributed and probably much closer to where the power plant is located, so they would turn to those reservoirs, which I indicated in my testimony, we know--we don't know as much about those reservoirs as we do the EOR fields.

Mrs. LUMMIS. So there is no good demonstration of the efficacy of saline reservoirs for storage?

Mr. TRAUTZ. Well, we have the Sleipner Project, which I

mentioned in my testimony, that's on a natural gas separation but we currently do not have a full-scale project that is planned for saline storage. That would be an integrated project with a power plant.

Mrs. LUMMIS. Mr. Hilton, can you expand on your statement that NSPS hurt the development of CCS?

Mr. HILTON. It is fairly simple. I mean, all of R&D is driven by what the market demands, and if there is no demand for CCS on gas and there is only on coal and coal is not built as a result of that, it becomes a decision, does industry continue to invest because we are already seeing frankly that DOE has run out of money to invest in it. They don't have any large funds. So it is up to the individual companies whether they want to continue to invest, and 10 or more years of waiting for a market is a long time.

Mrs. LUMMIS. Can you also discuss the importance of commercial guarantees and the commercial deployment of CCS?

Mr. HILTON. Yeah, everything we do--our industry has been incredibly successful and has lulled us all into the fact that there is all the power in the world that we ever want, and so as suppliers to that industry, we are expected to meet not just performance, and there are multiple performance guarantees on energy, on additives, on--there is also availability and liability guarantees with this equipment, and those come into potentially billions of

dollars of liability. And that is why we need to have this demonstrated, to know that the integration works because there is no one that is going to accept that billions of dollars of liability otherwise.

Mrs. LUMMIS. Thank you, gentlemen.

I yield back, Mr. Chairman.

Chairman SCHWEIKERT. Thank you, Cynthia--Chairwoman Lummis.

Ranking Member Bonamici.

Ms. BONAMICI. Thank you, Mr. Chairman.

Mr. Hawkins, thank you for bringing your years of expertise to the Committee. On your testimony, you talk about how regulation has led to the development of technology. I think we are talking about a chicken-and-egg thing here. You note that CCS systems like sulfur scrubbers, mercury controls, fine particulate controls, nitrogen oxide controls, for example, were not used until they were regulatory requirements to control those pollutants. So I want to talk just a little bit about how the legislative history of the Clean Air Act supports the EPA's proposed rule on new power plants, and it is my understanding that the Senate committee that crafted Section 111 stated that the section was designed to promote constant improvement in techniques for presenting and controlling emission from stationary sources and an emerging technology used as the

basis for standards of performance need not be in actual routine use somewhere. So can you please discuss how EPA regulation has in the past led to the development of critical environmental technology?

Mr. HAWKINS. Yes, ma'am. The regulation as a driver of technology is well documented both in academic literature--I am thinking of reports by Ed Rubin of Carnegie Mellon University. The fact is that in the power sector in particular, it is a very competitive sector in terms of the hours of operation of individual power plants. So a power plant that has a fractionally higher cost of electricity production is not going to run as much, and that is going to lose money or not earn as much money for the owner of that power plant. So power plant operators are extremely reluctant to do anything that has the slightly increase, even if it would be invisible in the customer's bill because it determines the hours of operation and what is called the dispatch order of that power plant.

So regulation or money are the essential ingredients to make advances, and if you don't have money, then you need standards, and that is why the Nixon Administration proposed what became the New Source Performance Standard in the 1970 Clean Air Act to advance technology deployment in new sources of air pollution, and the power sector is an excellent example of how that has worked very well. The coal industry

and the power industry tout in ads how much of a reduction in the conventional pollution has been achieved at the power sector, and they are correct. What they don't say is it all came about because of regulation. It came out because of regulation requiring scrubbers, it came about because of regulation requiring bag houses for particulate matter, it came about for regulation requiring nitrogen oxide controls, and most recently, mercury and other toxin controls, and the same process will happen as we turn to carbon dioxide. Carbon dioxide is just another chemical. There are industrial processes for separating it just as there have been for conventional pollutants, and the sooner we get on with it, the better off we will all be.

Ms. BONAMICI. Thank you. And I wanted to ask you also, Mr. Hawkins, to follow up on the discussion that we have been having about the research that has been done to be able to determine appropriate locations for carbon storage. Could you please respond to some of the comments that have been made about whether there are appropriate locations for storage?

Mr. HAWKINS. Yes. President George W. Bush's Administration began what has been a comprehensive approach to surveying the site availability for geologic storage. And fortunately, the United States is blessed with huge amounts of the geologic formations that are appropriate for storage

of CO2. Essentially you need--as Dr. Trautz has indicated, you need a porous formation that is sufficiently below the surface of the earth to keep the injectant pressurized, and then on top of that, you need a permeable formation, and we have done surveys of the extent of these types of formations in the United States, and we have huge volumes of them, enough for more than 100 years of all current power plant emissions as was--

Ms. BONAMICI. I want to get one more quick question in to you, Mr. Hawkins. How much will the proposed CCS reduce carbon emissions if you compare a plant with CCS and compare a plant without it?

Mr. HAWKINS. If you compare it with and without, it would be about a 50 to 60 percent reduction in that power plant's carbon dioxide emissions, and that is a very substantial emission reduction and one that would demonstrate world leadership and provide a market for U.S. manufacturers as this technology was deployed.

Ms. BONAMICI. Thank you. I see my time has expired. I yield back. Thank you, Mr. Chairman.

Chairman SCHWEIKERT. Thank you, Ms. Bonamici.

Mr. MILLER. Mr. Chairman, may I respond to that first question?

Chairman SCHWEIKERT. Actually, as we work our way around, we will get there, because--and I appreciate some of

the technical responses. Actually, I am going to give myself a few minutes here and just sort of do a little bit of digging, because I wanted to try to get my head around some of the mechanics.

And you corrected me before. Is it Trout?

Mr. TRAUTZ. It is Trautz, like the fish, spelled different.

Chairman SCHWEIKERT. That is not spelled like it. You need to change your name and spell it the right way.

Mr. TRAUTZ. It is the German spelling. Sorry.

Chairman SCHWEIKERT. In the notes and the mechanics that have been given to me, my understanding is, not too long ago in front of the Science Advisory Board at the EPA, there was a discussion that the sequestration of ACO2 just had to sort of demonstrate the adequacy and the achievability. But yet, you know, I am being sent letters, and here is one from the American Water Works Association, and without objection, I would like to put it into the record. No objections? Oh, good. Because I always hate to object to myself. I will put that in.

[The information follows:]

********** INSERT 12 **********

Chairman SCHWEIKERT. And part of the question they are on is saying do we really have enough data of our threat to potable water supplies, and we heard Mr. Miller talk about his experience in his state where they thought they had a saline level and it turns out it did not work. Do we have robust literature that says what our threats are and what they are not to potable water supplies?

Mr. TRAUTZ. So the answer to the question, there have been a number of research studies that have looked at CO2 and the potential impact if it were to leak out of a reservoir, twat the potential impact would be on potable groundwater.

Chairman SCHWEIKERT. Can you answer this too? Tell me the nature of the studies

Mr. TRAUTZ. One of the studies EPRI performed, it was a field study where we actually introduced CO2 in the dissolve phased and groundwater into a portable reservoir and looked at the impact.

Chairman SCHWEIKERT. And what scale was that done at?

Mr. TRAUTZ. It is a very small scale. It just was there to simulate hypothetical release of CO2.

Chairman SCHWEIKERT. And when you are doing that sort of study, and this is just me sort of getting myself technically up to speed, you use actually human--I guess the term is food-quality, food-grade CO2?

Mr. TRAUTZ. Yes, food-grade CO2.

Chairman SCHWEIKERT. As part of your test mechanism?

Mr. TRAUTZ. That is correct.

Chairman SCHWEIKERT. And what were the conclusions? What did the model tell you?

Mr. TRAUTZ. So what happened was the CO2 as it dissolves in the groundwater, it lowers the pH, and the pH can then start to dissolve mineral phases that are in the aquifer materials themselves and it can release heavy metals. It can also release heavy metals from the disassociation or the surface complexes that are on clays and other minerals. It can dissolve and come off of those surfaces and into solution, so heavy metal contamination is one of the biggest issues.

Chairman SCHWEIKERT. Mr. Trautz, a modern--let us say you and I tomorrow were building a modern power generation facility that was using coal. How much CO2 would it produce for this model? Because you were telling me in northern Europe we have a couple projects that have been up and running for a while but they max out at about a million.

Mr. TRAUTZ. A million tons per year, yes.

Chairman SCHWEIKERT. And that is metric tons?

Mr. TRAUTZ. Metric tons, yes.

Chairman SCHWEIKERT. What would a modern facility produce?

Mr. TRAUTZ. Again, a 1,000-megawatt power plant, a

pulverized-coal plant, would produce about 3.1 million metric tons per year and over a lifespan of 40 years, the example given in the testimony was 120 million metric tons.

Chairman SCHWEIKERT. And do we have models that would say we even have places to do such storage that we would be safe and comfortable and long after the shutting down of such a facility we would have no fissures or other--

Mr. TRAUTZ. Yes, we do have geomechanical models that can be used to predict the behavior of pressurizing a reservoir, so those are available.

Chairman SCHWEIKERT. And then to move on beyond the models, what demonstration projects do we have at scale?

Mr. TRAUTZ. As I mentioned in my testimony, on saline reservoirs only, the two that we have is the Mountaineer Project. That was about 37,000 metric tons total. And then there's Plant Barry, which is part of the SECARB Project, which EPRI is part of, and that is a little over 100,000 metric tons at this point.

Chairman SCHWEIKERT. Okay. So in many ways, our demonstrations are still sort of fractional in scale?

Mr. TRAUTZ. They are very, very fractional, yes.

Chairman SCHWEIKERT. Okay. If I were to look around the world, you are telling me right now that the largest scale we have is at a million metric tons, and that is a million metric tons on an annual basis?

Mr. TRAUTZ. That is correct.

Chairman SCHWEIKERT. And for how many years?

Mr. TRAUTZ. The Sleipner Project has been going on since 1996, so almost 20 years. It is the longest experience. The Snohvit Project has started up in 2008. The Sleipner--or pardon me--the In Salah Project started up in 2008 and shut down or was suspended in 2011. We have one other large CO2 project that is coming online that will also be a gas separation project, and that is the Gorgon Project in northwestern Australia. That will be on the order of a power plant.

Chairman SCHWEIKERT. Okay. So that we actually will have some demonstration coming on a large scale?

Mr. TRAUTZ. On natural gas, yes.

Chairman SCHWEIKERT. Why was the one shut down in North Africa?

Mr. TRAUTZ. Because the CO2 pressure was too high and it ended up fracturing the lower part of the cap.

Chairman SCHWEIKERT. And their models didn't predict that?

Mr. TRAUTZ. No, apparently not.

Chairman SCHWEIKERT. Okay. All right. I am actually somewhat over my own time, so I am going to yield to Mr. Swalwell.

Mr. SWALWELL. Thank you, and Mr. Chair, I am moving

left. I was over there, I am here, and by the end of the hearing I will be right here.

I just want to start by asking our witnesses just a yes or no, and I will go down the line and start with Mr. Hawkins. Do you agree with the 97 percent of the scientists who say with 95 percent certainty that climate change is happening as a result of activity by humans? Mr. Hawkins?

Mr. HAWKINS. Yes.

Mr. SWALWELL. Mr. Hilton?

Mr. HILTON. Yes.

Mr. SWALWELL. Mr. Trautz?

Mr. TRAUTZ. Yes.

Mr. SWALWELL. Mr. Miller?

Mr. MILLER. I am not a scientist to say yes or no on that.

Mr. SWALWELL. Okay. So I want to start, Mr. Hilton, you stated that you had concerns that DOE is out of money and does not have enough money to implement this, and were you aware that back in December they announced an $8 billion loan guarantee for these programs?

Mr. HILTON. Absolutely, but a loan guarantee doesn't give you money. It guarantees failure and recoup of the loan. The problem is to do a project and then get it financed, and you might notice, there has been no carbon capture projects applying for the $8 billion.

Mr. SWALWELL. Would hundreds of millions of dollars though, that we have for R&D that is proposed in the budget, would that be sufficient?

Mr. HILTON. Well, there is only something on the order of about less than $100 million in the CCS program. What I am talking about is the kind of programs that lead to the demonstrations like the proposed Summit Project, the projects that have been delayed, where they put, our--if you will, our project at American Electric Power. But we had $450 million but the public utility commission refused because there was no regulatory requirement to allow the utilities to recover any costs on the project, so those are the kind of funds we need and those don't exist in the DOE budget.

Mr. SWALWELL. Mr. Hawkins, does NRDC, one of the country's most respected environmental organizations, believe that there is a role for coal in our Nation's energy future, and if so, why, if not, why not?

Mr. HAWKINS. We do believe that there is a role for coal. How long that role will last is a matter of conjecture. It will, in our view, depend on a combination of factors including whether coal can be brought into the 21st century and perform as an energy resource that is consistent with our other needs: to protect our society's dependence on a stable climate. Right now, it is not consistent, and whether it becomes consistent is precisely the topic of this

hearing, and we thank you for holding it.

Mr. SWALWELL. Do you think that EPA standards are putting coal plants out of business or the clean natural gas boon putting coal plants out of business?

Mr. HAWKINS. The biggest challenge to coal investments today is the marketplace. We have slack power demand, in part due to the continuing effects of the recession, in part due to good things like energy efficiency and the improved renewables production, and we have abundant, low-cost natural gas, and that makes it very difficult for investors to look at a new coal project and say this is where we should put our money. It is just not attractive.

Mr. SWALWELL. And Mr. Hawkins, do you believe that it would be appropriate for the EPA to establish standards requiring implementation of CCS at existing plants? And I draw the distinction between those plants existing now and the proposed regulations for the future.

Mr. HAWKINS. We think that CCS should be permitted as a compliance technique for any regulation of existing power plants but we have not seen an analysis that would suggest that it should be required across the board and meet economic tests.

Mr. SWALWELL. And Mr. Hawkins, how can EPA determine that a technology is adequately demonstrated if it not yet commercially available? Any thoughts on that?

Mr. HAWKINS. Yes. The difference between commercial availability and adequate demonstration is very specific to the sector that is being looked at. So commercial availability asks the question, is there a vendor that can--that is willing to provide a commercial product to a particular type of industrial source, and if there is no market for it, the answer is often no. Actually in this case, there are vendors who provide commercial carbon capture systems for power plants so in this case, there is commercial availability, there just isn't commercial use because there is no reason for the power plant operators to use it.

Mr. SWALWELL. Great. Thank you, Mr. Hawkins.

And with that, I will yield back the balance of my time.

Chairman SCHWEIKERT. Well, you don't have any more--no. Thank you.

Mr. Hall.

Mr. HALL. I thank you, Mr. Chairman, for holding this combined hearing and very capably so.

I appreciate hearing from the witnesses, or at least I appreciate hearing from some of them, their major concerns, not just concerns but major concerns with the proposed rule. Some of those concerns have been raised by the Attorney General of Texas. He has filed some 30 suits, I think, against this Administration, who seems like can't tell the truth, can't even call a terrorist a terrorist. But he has

filed a number of suits, and not just him but the Attorney Generals from Oklahoma, Alabama, Michigan, Nebraska, South Carolina, Wyoming, in their February 28th letter to Administrator McCarthy. Without objection, I would like to enter their letter into the record.

Chairman SCHWEIKERT. Without objection.

Mr. HALL. Thank you, sir.

[The information follows:]

********** INSERT 13 **********

Mr. HALL. I would like to commend the Texas Attorney General one more time, Mr. Greg Abbott, who has worked tirelessly to stand up against this Administration's what we call advanced federalism. Mr. Abbott and the other States' Attorney Generals are concerned about the EPA's draft underground injection control program guidance on transitioning class II wells to class VI wells. To move it would interfere with the authority granted to the States under this program. The proposed new class of wells, class VI wells, would create new regulations in connection with prospective carbon capture and storage operations. The Attorney General's letter states, and I quote, ''Notwithstanding this new class of wells intended to accommodate the underground injection of CO2, many oil and gas producers operating class II wells have been injecting CO2 for the past 40 years to manipulate well pressure and enhance the recovery of oil and gas. This process, commonly referred to as an enhanced oil recovery, has been used in more than 10,000 wells, about 7,000 of which are currently active, and EOR represents a critically important part of our state and our country's energy infrastructure and plays an essential role in our Nation's economic stability and energy. The concern raised is that class II wells for EOR operations could be reclassified as class VI wells under the EPA's draft guidance, a situation that is creating an unnecessary level

of uncertainty and risk to a mature area of industry that is already well regulated.'' So I join the Attorney General in calling for the EPA to take immediate action to rectify this situation created by the draft guidance and eliminate the uncertainty and ensure strict adherence to the applicable law. So I ask you a question, Mr. Trautz. Did I say that correctly, sir?

Mr. TRAUTZ. Trautz.

Mr. HALL. That is what I said, I thought. Sir, in your testimony you noted that geology is not uniform. What specifically are the differences in geology that might make it more or less difficult to sequester carbon in different regions of the country?

Mr. TRAUTZ. Yes, so the geology is not created equal, so to speak. If you go to the northeastern United States, there is bedrock, crystalline rocks that will not hold CO2 capacity. There isn't sufficient capacity up in the Northeast, so they make for poor reservoirs, and there is very limited availability of storage. Go to other areas of the United States and you will find much better reservoirs like in the Southeast.

Mr. HALL. Let me ask you this. Are there parts of the country that simply does to have the geology for storage?

Mr. TRAUTZ. Yes, sir. The Northeast is one of those.

Mr. HALL. And what other options would power plants in

those locations have for managing carbon dioxide? Can they simply store the CO2 on site?

Mr. TRAUTZ. No, sir, because of the volume, but they would have the possibility of creating a pipeline that would then take that CO2 to better storage reservoirs.

Mr. HALL. Do you think the EPA's proposed rule will put specific states and regions at a competitive disadvantage in terms of compliance?

Mr. TRAUTZ. In terms of compliance?

Mr. HALL. Yes.

Mr. TRAUTZ. No, I don't think in terms of compliance.

Mr. HALL. Well, then, let me ask you this. Do you believe CO2 pipelines can solve this problem?

Mr. TRAUTZ. That has been one of the possible avenues, yes, sir, because we do have CO2 pipelines that stretch down from Colorado into the Permian Basin in the--

Mr. HALL. Thank you, and my time is just about up. I would also like to note that although environmentalists are supporting EPA's proposed source performance standards rule, I would like to enter into the record an article written this week explaining the Sierra Club and the other environmental groups that are actually opposing the Kemper Project that the EPA cites as an example of CCS.

Chairman SCHWEIKERT. Without objection.

[The information follows:]

1232 ********** INSERT 14 **********

Mr. HALL. With that, Mr. Chairman, I thank you and I yield back.

Chairman SCHWEIKERT. Thank you, Mr. Hall.

Mr. Veasey.

Mr. VEASEY. Thank you, Mr. Chairman.

I wanted to touch on a little bit what Congressman was just talking about a little bit. I know that many of the witnesses today have touched on the viability of storage technology for CO2, especially in EOR, and in Texas, you know, we have been doing this for a while, as it was already stated, particularly in the Permian Basin, and we have a complete pipeline structure that has been built around this process with the newest one being the Green Pipeline Project that was completed a short time ago transporting CO2 from Louisiana to Texas, and the process has become so economically viable that now there is a shortage of CO2, raising the price upwards to about $30 per ton. I wanted to ask Mr. Hawkins and Mr. Miller, while CO2 storage may not be feasible in one area of the country as it was stated a little bit earlier, aren't those other areas such as the Gulf Coast that actually have a high need and capacity for CO2 storage?

Mr. HAWKINS. Yes, Mr. Veasey. EOR is a great win-win-win opportunity for energy security, climate protection and I would argue for other environmental protection. We have lots of oil that is stranded in existing

oil fields. It is not economic to get it out. It could be gotten out starting tomorrow if the CO2 were available. The CO2 isn't available because it is all going up into the air from uncontrolled industrial sources. We have an easy fix, which is to find a way of working the economics so that we put carbon capture on these power plants and then we use a pipeline network and expand pipeline networks, and the pipelining of this is easy. It is being done today. It goes hundreds of miles from southern Utah down into west Texas. It goes from hundreds of miles from North Dakota up into Saskatchewan. Oil field operators are making money when the CO2 is available. This is proven technology. And in terms of distances, you know, the idea that it might rule out some locations in the United States for coal, that just doesn't hold water. We transport coal thousands of miles from Wyoming to the southeastern United States. We can transport the CO2 from that same coal a few hundred miles back to EOR, no problem.

Mr. MILLER. My response would be on multiple levels. Number one, natural gas, or CO2 pipeline is feasible. Technologically, it is out there and it is happening. They are expensive. You ran into some ''not in my backyard'' issues as you are putting in the pipeline, but they can be put in. You have--now you are transporting your CO2 to another area so you have a variety of environmental

liabilities that you are going to be taking on and moving to another area of the country and so there is liability that goes back to your community.

And then finally, on the EOR side--and this is not my specialty but what I have been reading on that is, CO2 is a very expensive product and people are buying that and they are using that as a working fluid, but they are capturing that CO2 back out and continuing to use that as a working fluid. So it is not really a sequestration technology, it is a technology that is used to capture energy and recover energy and gas, so I don't see EOR as sequestration as much as a use of the CO2, and that is what is driving up the costs. They are trying to get that. They are using that fluid. But once they inject it in, they try to get that back out so they can use it again.

Mr. VEASEY. I think that both of you would agree that Texas has had a long history of using CO2 in plugged oil wells with very little environmental damage, and wanted to ask you specifically about the regulations for EPA's New Source Performance Standards. Based on what we heard from Mr. Hawkins just a second ago, wouldn't there--wouldn't we create more of a market under these regulations for CO2?

Mr. HAWKINS. Well, I think there would. The recycling that the witness mentioned is correct but it is only a fraction. About 30 percent of the injected CO2 comes up in

the oil, and industry practice is to put that back down. But there is a net additional injection of about 50 million tons a year now, so it is storing lots of CO2, and yes, the oil industry would love to have additional supplies of CO2 but we have a disconnect in the marketplace because there is no policy requirement to capture CO2, and given the other aspects of the marketplace, there is no economic rationale because the costs of capture are high enough that you can't earn money back in the typical situation for selling it for EOR. Now, there is some niche situations where you may be able to make a profit even today without a regulation, but to make this expanded, you will need regulations to drive it.

Mr. VEASEY. Thank you. Thank you, Mr. Chairman.

Chairman SCHWEIKERT. Thank you, Mr. Veasey.

Mr. Rohrabacher.

Mr. ROHRABACHER. Thank you very much.

First and foremost, we need to recognize that this debate, this discussion is predicated on certain premises that I disagree on, and those of us who think that the concept of global warming is fraudulent and that has not been proven, we obviously are much more--those of us who don't accept the idea that there are--for example, when we hear that 97 percent of the scientists, we hear something like that quoted, we go my goodness, 97 percent of the scientists believe that. Well, I am sorry but 97 percent of the

scientists that were contacted by a specific group who--97 percent of those scientists who replied from that questionnaire said that, not 97 percent of all the scientists as we hear repeated over and over again. We repeat--it used to be repeated that we had global warming and now it is called climate change because it didn't get any warmer. We in fact had all of the people=--those of us who have been around long enough to remember how adamant it was that there was going to be a 5-degree jump in the temperature over the last 15 years, and instead we have had absolutely flat temperatures. So there is a premise that those of us on this side may disagree that maybe the whole basis of the discussion is wrong but let us get into the debate of the discussion today, which is we are talking about CO2 and the sequestration that is being pushed on us in the name of stopping global warming where they now call it climate change because the global warming stopped 15 years ago.

The gentleman from Texas just presented us a good picture of how in Texas they are utilizing CO2 in the production of oil. Now, let me ask the panel: If we then change the nature of the CO2 from being a natural source of CO2 put into the ground and we now are mandating that it is a byproduct of coal, the use of coal, that CO2, doesn't that change the regulatory mandates that the industry has to put up with and wouldn't that so dramatically change those

regulatory mandates that it would make it almost impossible then to use even the coal that is our--even the CO2 that is now being used by the industry if you would intermix the CO2 from coal production with natural CO2? Does anyone on the panel know anything about that?

Mr. HILTON. I think that the issue that you are addressing, sir, is, what has been expressed by people like Denbury is, you know, they would not choose to overlay the costs and the difficulty of subpart RR in regulations and they would--if they continued to use natural CO2, they are subject to those regulations.

Mr. ROHRABACHER. Right.

Mr. HILTON. But if they were to bring in any CO2 from a power facility, they would become subject to those regulations, and as I said, Denbury has issued a public statement saying that they would not use that because of cost and the impact on operations.

Mr. ROHRABACHER. So what we just heard from our very sincere colleague from Texas about--it would destroy the very thing that you are bragging about. The fact is, it would put a whole new regulatory burden just to utilize this CO2 byproduct of coal production into the natural CO2 would prevent or at least dramatically increase the cost of the very thing that you were talking about, which is CO2 is used now by the oil industry.

Yes, sir, go right ahead.

Mr. HAWKINS. Yes, Mr. Rohrabacher. Let me read a very short sentence from the Denbury Web site. ''CO2 EOR is increasingly being viewed as a strategy to reduce carbon emission from various current and proposed industrial facilities. Our CO2 process provides an economical and technically feasible method of CO2 disposal.'' So Denbury is holding itself out as being a source for disposal of industrial CO2, and we don't think it is sustainable for them at the same time to say if they are required to report on what happens to that CO2, they will refuse this business. We just don't think that washes.

Mr. ROHRABACHER. Well, we don't think it washes, but obviously there are a lot of people in business who have to put up with the regulations and the bureaucrats and the mandates and the government intrusions into the decision-making and the extra costs that government mandates will have have said we are concerned about that, and it actually--you are bringing a whole new set of fundamental laws that have to be dealt with by combining natural CO2 with a byproduct of coal. You--all of a sudden CO2 then is treated not as a natural material but as some sort of a toxic substance. As a toxic substance, it is highly regulated and a situation that would add dramatically to the cost and complication of doing business.

Of course, it would be very well intended. Obamacare was very well intended as well. Thank you very much.

Chairman SCHWEIKERT. Thank you, Mr. Rohrabacher.

Mr. Neugebauer.

Mr. NEUGEBAUER. Thank you, Mr. Chairman, and thank you for holding this joint hearing.

Mr. Miller, you know, this panel and previous panels have testified pretty consistently that CCS is not adequately demonstrated and not necessarily completely commercially available. So if that is the fact, then what are the implications for your customers, you know, City Utilities, retire older plants and add new--need to add new sources of power? What is going to be the consequence if EPA moves forward with these regulations?

Mr. MILLER. Well, it could go a variety of directions but ultimately we have the obligation to serve our customers, and as a municipal utility, the money we spend is not shareholder money, it is our customer money, and so first of all, if we are in a retirement mode where we retire assets, it was mentioned earlier that some assets will be retired before the end of their useful life but you are still paying on those. Your customers have paid for those assets, so that is a loss of money there. Now you have to find either the ability to install not demonstrated technology--and I have been on the end where I have had to install demonstrated

technology, whether it be a scrubber or selective catalytic reduction, and you buy those from vendors that are commercial. They have guarantees, and they are designed by nationally recognized engineers, and when you go to install those, you get surprises. Even commercial equipment, you still get surprised and there are some additional costs, and those costs flow back to your customers. So you are going to--our customers will pay more because you have assets that are retiring. You are putting in non-proven, non-demonstrated technology which ups the amount of risk that you are going to take on that you are going to find problems as you implement that technology, and that is cost. So those are all driving cost, increasing cost to customers, and so whether you buy it from the market or whether you install the technology that is not demonstrated, and when you retire the assets, that all flows back in our case right back to our customers. And so we are very protective of that because we have that obligation to serve, and they own us.

Mr. NEUGEBAUER. And so the next step of that is, okay, so you have those options out there, assuming that you have those options, it could increase the cost because of the increased cost in technology. Here is my question: If we keep going down this path of, you know, being anti-fossil fuel for the production of electricity in this country, whether it be coal or natural gas, you know, doesn't that

begin to limit our options? In other words, your utility is not the only utility in the country that is, you know, facing this issue, and so we this massive consolidation of all these different communities or providers for communities looking for power sources, and if we begin to limit the choices, how do we keep the lights on?

Mr. MILLER. You are basically shrinking your subset of options, and these--as was mentioned earlier, it takes a long time to get these generating sources on and up and operating, and so you start limiting your capacity and you start running the potential of having reliability problems, not only in your region--or in your area but in the region, and you are putting a lot of pressure on these much reduced options available to your customers.

So the answer is, we still have that obligation to serve. We are still going to do everything we can but you increase your risk of reliability issues across the Nation, and it also drives costs into the business world, and so your economic development picture changes too. Instead of adding jobs in your community, you might be freezing jobs or you might be reducing jobs or moving them elsewhere. So it impacts our low-income customers but it also impacts our economic development within our communities.

Mr. NEUGEBAUER. Mr. Miller, you were reading my mind because the next question I have is, okay, so we have got

reduced capacity so we got a reliability factor and probably got a lot of price pressure then because you have got all of these people competing that have these contracts to deliver power, and they are looking for that power. And so the question is--and you mentioned it--is that, you know, job creation, you know, the impacts on businesses, manufacturing businesses, all kinds of business. It is pretty hard to run a business in this country without power.

And so that is the reason I am going to ask unanimous consent, because Heritage just recently did a study that I think is important to the record, Mr. Chairman, and I will just read a little bit from that. It said that according to the report, by 2023 we can expect to see nearly 600,000 jobs lost nationwide with Texas losing 25,000 jobs and over 330,000 manufacturing jobs could be lost because of this rule, and in my district alone we could expect to see maybe 400 people lose their job. So without objection, Mr. Chairman, I would like to put the Heritage report as a part of the record.

Chairman SCHWEIKERT. Any objections? So ordered.

[The information follows:]

********** INSERT 15 **********

Mr. NEUGEBAUER. And I yield back the time I don't have.

Chairman SCHWEIKERT. Thank you, Mr. Neugebauer.

Mr. Cramer.

Mr. CRAMER. Thank you, Mr. Chairman, and I thank the witnesses for your testimony today.

Before I forget, I want to do it right upfront or I almost certainly will, I want to place into the record without objection a letter from the North Dakota Industrial Commission that represents their comments on this rule. The Industrial Commission of North Dakota is made up of three separate elected officials who come together on the Commission. They are the Governor, the Attorney General and the Commissioner of Agriculture. So I would like to place that in the record.

Chairman SCHWEIKERT. Without objection, so ordered.

[The information follows:]

********** INSERT 16 **********

Mr. CRAMER. Before I speak about what the Commission had written about, I am very pleased to know, Mr. Hawkins, that the Natural Resource Defense Council supports interstate pipelines, international pipelines even. Your reference to the CO2 line from the gasification facility in North Dakota, which I helped site when I was on the Public Service Commission, to Weyburn, Canada, for enhanced oil recovery--by the way, when we sited it, we had a hearing and not a single person showed up. That is the way it is in North Dakota with good ideas.

And so I am--however, your comment that pipelining is easy, I have to take some exception with. If building international and interstate pipelines was easy, we would have a lot more of them right now. We would have--

Mr. ROHRABACHER. Like Keystone.

Mr. CRAMER. Yes, for example. By the way, Chairman Hall, North Dakota's Attorney General is engaged so far in 12 separate lawsuits against their Federal Government, the EPA.

In the comments that the Industrial Commission writes that North Dakota really focuses on this issue of CO2 as an asset. It is an asset. It is a resource. The EPA treats it as waste, same with the porous base. We treat it as an asset. The EPA treats it as waste and consequently there is tremendous regulatory confusion as a result, and so I know I might be a little redundant but I want to flesh this out even

a little further. Maybe, Mr. Trautz, you could help me with this. Mr. Hilton made reference to it earlier. Could you--can you describe the requirement that EOR operators, you know, have to operate under differently than, say, traditional sequestration? Can you maybe flesh that difference out a little bit for us so that I have a better scientific understanding and why should it be that way, if you think it should or why it shouldn't.

Mr. TRAUTZ. The difference between the reporting requirements on the greenhouse gas mandatory reporting requirement is under Subpart RR. That is for geologic storage or sequestration. There is a--sort of a burden of proof that you have to do a mass balance on the CO2 that you put into the ground. You have to ensure or at least look at, put through a monitoring program that it isn't coming back up to the surface.

Mr. CRAMER. Um-hum.

Mr. TRAUTZ. Under Subpart UU it is--the burden of proof is frankly not even there. It is really just monitoring the CO2 that goes into the field, as well as fugitive emissions from your operations or facilities, so there isn't the same level of reporting that is required in certainly monitoring.

Mr. CRAMER. Maybe--and this could be for all of the panelists because there was reference earlier to previous rules and previous technological advancements. I think

mercury was specified, I think some of the others, I mean SOx, NOx. Was--is the commercially available or perhaps even the standard adequate demonstration of technology equal in this case in carbon capture as it was then with mercury and others, anybody or all of you? Mr. Hilton?

Mr. HILTON. Congressman, I can really address that. The answer is we were doing the technologies required either not in this country or in other industries that everything that was--that has been required under the Clean Air Act except for this. I mean, as I pointed out, we did scrubbers. The first scrubbers were at Battersea and Bankside, and they were there to protect the erosion of, you know, all of the buildings there. So we built these things for years.

And as I said, I worked on my first one before the Clean Air Act existed. So I mean it is--you know, we have done these things. NOx reduction was developed in Japan, not here, but the technology was there. And I know because my company was a licensee of those companies.

And so this is the first time we are dealing with something where we have nothing out there to show. And, you know, we are running down a path where Europe is not pushing this issue, China is not pushing this issue, India. We are alone out here. And so the technology has got to be developed here, you know, because--so I think, you know, this is the first issue where we haven't had the ability to--like

in waste and energy where we had full-scale plans on mercury in the '80s.

Mr. CRAMER. Well, I thank you. I look forward to the day when the technology does catch up because I would love to burn more than, you know, that 30 million barrels of--or 30 million tons of coal we burn in North Dakota every year. We have an 800-year supply of it, so I would like to burn it for 800 years and use it to get even more oil out of the ground. That is a noble goal.

Thank you.

Chairman SCHWEIKERT. Okay. Thank you, Mr. Cramer.

Mr. Hultgren.

Mr. HULTGREN. Thank you, Chairman. Thank you all for being here today for this really important hearing as we continue to assess technology as well as increased cost that EPA is mandating on the American people.

While the Administration and EPA continue pushing for the uncertainty of a closed-door regulatory approach as opposed to the balanced long-term solution our legislative body is supposed to provide for the American people, it is crucial that Members of Congress understand the technologies being mandated, as well as how EPA made their decisions.

While it is often hard even for Members of Congress to get answers from EPA, we unfortunately are the ones that have to go home and explain to our constituents what many see as

unjustifiable. I am certainly glad to have such a diverse panel before us today, and it will be beneficial to have experts before us that understand the technology and can explain to us the process and hurdles of energy technology innovation.

Mr. Hilton, I wanted to address my comments and questions to you if I may. Just to get an idea about how long the technology development process takes for energy technologies, I would like to discuss one of your projects with DOE that you briefly touched on in your testimony, the chemical looping combustion prototype for CO2 capture with the National Energy Technology Laboratories.

I know that in December 2012 NETL technology readiness assessment for the Clean Coal Research Program, your chemical looping combustion prototype was given a technology readiness of 5 out of 9. I wonder if you could explain to the Committee what a technology readiness level is and wondered if you could also talk about how valuable TRL is in assessing the viability of technology to perform on a commercial level.

Mr. HILTON. Well, it is basically assigning a level. There are characteristics to each level and assign how you move through the development into what is ultimately a commercially viable product. And chemical looping--and we really started on this and it depends when you really want to trace the roots, but let's say we started in earnest in

chemical looping as we know it now in the '90s, and if all goes well, we expect it to be commercial in the early '20s, 2020, because what we have to do is solve the problems of chemical looping, moving the solids around, extracting the solids, extracting the CO2, auto thermal ignition, you know, because in early stages you provide the heat to make things work.

So you get through this and then you have to bring them up from our current 3 megawatt unit to a 50 megawatt unit hopefully to something larger and eventually a full-scale because, as I said, when we go full-scale commercial, to get to that last level, that is what DOE and everybody else wants to see. So it is a long process in our industry.

Mr. HULTGREN. Yeah. I want to follow up on that a little bit. You mentioned the '90s. It is my understanding that your technology started bench tests in 1996. What would be the expected time frame for a project such as this? Could you go from bench testing to demonstration and then final commercial sale? Is that the 2020 number that you would say, so basically a 25-year to 30-year process?

Mr. HILTON. That is pretty typical--

Mr. HULTGREN. Okay.

Mr. HILTON. --for a process like this.

Mr. HULTGREN. And how often do technologies get the prototype scale before realizing they will not work on the

commercial level?

Mr. HILTON. More often than I would like to admit to, but R&D is--you know, it is kind of--to not have failure in R&D is just--is not an option--

Mr. HULTGREN. Right.

Mr. HILTON. --I mean because it wouldn't be R&D. You would already know the answers.

Mr. HULTGREN. Right. Since EPA is charged with determining whether a technology has been adequately demonstrated and DOE already has a process in place to assess technology readiness levels, it seems to me that EPA should rely heavily on the scientists who understand the technology. At what TRL would you consider a technology to be adequately demonstrated?

Mr. HILTON. Essentially, it should be toward the upper level of 9. I mean that is when you know things work and that is when you have built something that is large enough to say that this is something that can be applied.

Mr. HULTGREN. Okay. Well, thank you very much. Mr. Chairman, I yield back the balance of my time to the Chairman if you have any other questions. Otherwise, I would yield back my time.

Chairman SCHWEIKERT. Thank you, Mr. Hultgren.

Mr. Weber.

Mr. WEBER. Thank you, Mr. Chairman.

EPA claims that enhanced oil recovery will bring costs down for power plants and for domestic energy reduction, but the reporting requirements on EO operators will make it prohibitive for these companies to use CO2 from any future coal-fired power plants. These requirements will in fact inject, no pun--or maybe I should say pun intended--the EPA into a process that has long been successfully regulated by the States, especially my State of Texas.

As our colleague over there, dare I say on the right; I should say over on the left, Marc Veasey, alluded to. The State of Texas has--CO2 has been used for over 40 years in enhanced oil recovery. According to a detailed white paper, Mr. Chairman, which I have here from Denbury Resources, an EO operator located in Texas, ''the proposed NSPS rule will foreclose, not encourage''--I repeat--''will foreclose, not encourage the use of CO2 captured by emission sources in EOR operations.''

And, Mr. Chairman, I would like to submit this white paper into the record.

Chairman SCHWEIKERT. Without objection.

[The information follows:]

********** INSERT 17 **********

Mr. WEBER. Thank you.

Denbury Resources does use enhanced oil recovery, captured CO2. I have the--and that I know of, the largest and only CCS carbon capture and sequestration storage facility in my district in Texas, Port Arthur. It is--it was built/managed by Air Products at a cost of about $400 million. Sixty-six percent of the funding came from the Department of Energy or the American Reinvestment and Recovery Act, 66 percent of the funding.

Now, if you read in--if you read Air Products' news release on May the 10th, 2013, about that, let me quote from their product--their press release. ''This unprecedented achievement comes by way of an Air Products innovative technology is the first of its kind operating at such a large scale''--and here is the key phrase--''and has not been accomplished anywhere else in the United States.'' Further, down here they read--it says, ''this project''--they state that this project ''would not have been achievable without the support and involvement of the Department of Energy.''

To call this something that is capable of being duplicated in a viable process in the United States is a laugh. It is an absolute laugh. For the witnesses, are there any of you all who get 66 percent funding in your salary or that would admit it?

And are there--let the record show there is none, Mr.

Chairman.

Are any--there are--we have business people at the table, right, that are in business. Any of you all whose businesses get 66 percent funding from the Federal Government and would admit it?

Let the record show there are none.

Kemper, the project over in Mississippi, Kemper County, Southern Energy, the CEO came to the House Environmental Action--Energy and Action Team, which I am a member of, and testified some months--last year some months back and he said it is such a huge cost overrun and it is not applicable in--anywhere else in the United States. And that is with Denbury having a pipeline right in their backyard so to speak, which, fortunately comes over into my district in Texas.

Am I losing my microphone? No.

So how--for us to say that this is duplicable and that this has been demonstrated as a--capable of being duplicated process, for the EPA to say that is unbelievable in my opinion.

The--so we have seen from testimony today the prices for energy--Mr. Miller, for your customers, those that--as what Chairman Lummis said, demonstrably at the lowest economic rung will negatively impact those customers. Do you agree with that?

Mr. MILLER. Yes, sir, I do.

Mr. WEBER. You know, it seems to me it is irony of all ironies. We have got tax dollars, 66 percent of the project that the EPA alludes to, by the way, funding a process that we cannot duplicate that is going to hurt--you want to give new meaning to the term double jeopardy. We are using taxpayer dollars to fund a process that is going to hurt those who can least afford it at the bottom rung, maybe triple--let me just say maybe triple jeopardy.

I would submit for this panel--for this body that we are going to jeopardize, number one, those who can least afford the energy cost. We are going to jeopardize investment. There will be no new jobs at a time when we need it, and we are going to jeopardize our national security because we are going to need energy to operate the things--our military. We are going to need energy to produce goods, products, services, and we are going to triple jeopardized by trying to do this process the very economy in the greatest country in the world that is great--and I would ask any of you to disagree because we have the most solid, most affordable, most reliable, best supply of energy on the planet and we worked hard to get that way. And this is going to undermine the very process. Does anybody disagree with that?

Mr. HAWKINS. I disagree.

Mr. WEBER. You--that--

Mr. HAWKINS. I disagree that it will undermine all--

Mr. WEBER. I know. Well, I am--Mr. Hawkins, I am so glad you are here, glad to hear that, as my colleague over here said, you support pipelines. You said in your statement earlier that this--these regulations would help oil companies operate more profitably. I am so glad you are concerned about the oil companies. That is just something that is very admirable on your part.

And, Mr. Chairman, I have gone over my time so I yield back what I don't have.

Chairman SCHWEIKERT. Thank you, Mr. Weber.

Mr. WEBER. Thank you.

Chairman SCHWEIKERT. Mr. Bridenstine.

Mr. BRIDENSTINE. Mr. Hawkins, I just wanted to ask, can you explain a little bit about how EOR offsets the cost of carbon capture and storage?

Mr. HAWKINS. Yes. Currently, oilfield producers pay suppliers of CO2 that--they buy the CO2; they use it for injection. I don't know what the current price--going price is but it is more than $12 a ton of CO2, something like that. It might be as high as $20 a ton. Contracts sometimes specify it as a percentage of the price of oil, so as the price of oil goes up, the price that is being paid for CO2.

So the proposed builders of power plants like the Summit power plant project in Texas are negotiating arrangements

with off-takers of that CO2.

Mr. BRIDENSTINE. Is the regulation required to enhance that market for the carbon dioxide?

Mr. HAWKINS. Either regulation or lots of money that we don't have is required--

Mr. BRIDENSTINE. Yeah.

Mr. HAWKINS. --because the market will not support it given the current market structure.

Mr. BRIDENSTINE. Is that an official policy of NRDC?

Mr. HAWKINS. Which aspect, sir?

Mr. BRIDENSTINE. The regulation would be required to create the market for the CO2 for EOR.

Mr. HAWKINS. That is our belief that--based on an analysis of market conditions that it won't happen without a requirement.

Mr. BRIDENSTINE. Can you share with me the difference between a Class II well and a Class VI well?

Mr. HAWKINS. I would be happy to provide you with our comments on Class II and Class VI, yes.

Mr. BRIDENSTINE. I have a document here from NRDC that suggests that Class II wells are insufficient for EOR but certainly Class VI wells would be better? But it seems like there aren't very many, if any, Class VI wells, is that correct?

Mr. HAWKINS. Our position is that for geologic

sequestration activities where the company is proposing to permanently retain the CO2 underground, there ought to be some demonstration beyond what is required under current Class II rules that the CO2 will actually stay underground. That is our position.

Mr. BRIDENSTINE. So on the one hand we need EOR to make the market for CO2 viable; on the other hand, we want to severely limit EOR for--you know, for the extraction of oil, is that correct?

Mr. HAWKINS. No, it is not correct, sir. Requiring companies to do reasonable monitoring and reporting will increase confidence that this--

Mr. BRIDENSTINE. But the reality is--

Mr. HAWKINS. If I might finish, it will increase confidence in the public that this is in fact a secure solution and that the operators are behaving responsibly.

Mr. BRIDENSTINE. If you limit EOR, it cannot be used to offset the cost of carbon capture and storage.

And, Mr. Chairman, I would like to submit this document from the NRDC as far as the difference between Class II and Class VI wells and why NRDC seems to believe that it is necessary to limit EOR.

[The information follows:]

********** INSERT 18 **********

Mr. BRIDENSTINE. I would like to just, I guess, ask the panel. Mr. Miller, if you would share with me as somebody who operates utilities. We have an issue in my State of Oklahoma where, you know, we are literally closing down coal-fired power plants, and it is going to cost consumers in my district in the Tulsa area. We are going to see rates go up. Some people are saying it is going to go up 6 percent, some people are saying 20, some people as much as 40 depending on the time horizon. Over the next 10 or 20 years it is going to be a significant increase.

The challenge here is that coal is stable, the price is stable, and natural gas, we are seeing spikes across the country in very specific regions when it gets cold, which it still does get cold in places. In New York we saw it--you know, the price of natural gas went up to, you know, over $90 in certain areas. That creates a huge risk in my opinion, $90 per thousand cubic feet. It is a huge risk. In Colorado it went up recently, you know, $45 per thousand cubic feet. This is now something that we are going to have to deal with in Oklahoma because of the shuttering coal-fired power plants. Would you share with me your thoughts on that?

Mr. MILLER. Well, we just experienced that in your State. In our region just a week or so ago we had a cold spell and there were plants that were supposed to run during that coldest day going from Sunday into Monday, and when they

went to run, there wasn't enough gas supply.

So within our region, Oklahoma, Missouri, and Arkansas area, we had plants--we had up to 1,700 megawatts that were supposed to run that they--that did not, and then we saw natural gas prices go from about $5 up to $20 plus for a couple days in a row and it was because we had constraints in pipeline and we had generating units that couldn't run because we didn't have the gas that can be delivered to them.

And as we see more of these regulations come on in 2015 and '16, you will see a more generation--coal generation come off-line, but I am not sure where that capacity is to replace it. So we will be feeling the pressure within the marketplace over the next few years.

Mr. BRIDENSTINE. Thank you. I yield back.

Chairman SCHWEIKERT. Thank you, Mr. Bridenstine.

Ms. Bonamici had something quick she wanted to share.

Ms. BONAMICI. Thank you very much, Mr. Chairman.

As we conclude the panel, I wanted to thank every one of you for coming here today to inform us.

I also wanted to say something about a comment that was made earlier about thanking or appreciating only some of the witnesses today. All of you have spent a lot of time preparing for this hearing, traveling here to inform us, to share your years of expertise, and even though every one of

us might not agree with everything that every one of you said, you all deserve to be thanked and appreciated.

Thank you, Mr. Chairman. I yield back.

Chairman SCHWEIKERT. Thank you, Ms. Bonamici.

And I want to thank the witnesses for their testimony and the members for their questions. And we will ask you to respond to those questions in writing.

You know, there are so many things--this is one of those I wish I could have a day with no one else because there are so many odd technical things I would like to understand of, you know, the optionality that is available in these technologies, what is robust, what isn't, and even just the whole discussion on EOR and the practicalities of how do you both incentivize that but at the same time do--some of the regulatory approaches, do we change the cost structure in a way where we lose that opportunity?

So with that, this panel is dismissed. Thank you for your valuable time today.

I think we are going to take about 90 seconds and everybody grab a cup of coffee and we will move on.

Okay. I would like to introduce our second panel, which is--and it is pronounced McBride?

Ms. MCCABE. McCabe.

Chairman SCHWEIKERT. McCabe, sorry.

Our second panel witness is Janet McCabe, Acting

Assistant Administrator of the Office of Air and Radiation in the Environmental Protection Agency. Previously, she was at the Office of Air and Radiation, Principal Deputy to the Assistant Administrator. Prior to joining the EPA, Ms. McCabe was the Executive Director of Improving Kids' Environment, Inc., a children's environmental health advocacy organization. She also previously served in several leadership positions in the Indiana Department of Environmental Management Office of Air Quality.

Ms. McCabe, you have 5 minutes. You know the routine, yellow light, talk faster.

STATEMENT OF JANET MCCABE, ACTING ASSISTANT ADMINISTRATOR, OFFICE OF AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY

Ms. MCCABE. All right. Thank you, Mr. Chairman.

Chairman Schweikert and in absentia Chairman Lummis, Ranking Members Bonamici and Swalwell, and members of the committee, thank you for the opportunity to testify today.

Climate change is one of the greatest challenges of our time. Our changing climate already threatens human health and welfare and economic well-being through the increased intensity and frequency of severe heat waves, a rise in sea level affecting our coastal businesses and communities, and a combination of rising temperatures and changing precipitation that leads to increased droughts and wildfires. If left unchecked, climate change will have devastating impacts on the United States and on the planet.

Last June, President Obama issued a national Climate Action Plan directing the EPA and other federal agencies to take steps to mitigate the current and future damage caused by greenhouse gas emissions and to prepare for the climate changes that have already been set in motion. Climate change is also a global challenge, and the President's Plan recognizes that the United States must couple action at home with leadership abroad.

Today, you have asked me to focus on the critical role EPA plays in implementing one of the central activities in the Climate Action Plan: cutting carbon pollution from new power plants. In March of 2012, the EPA first proposed carbon pollution standards for future power plants. After receiving over 2.5 million comments, we issued a new proposed rule based on this input and on updated information.

In September of 2013, the EPA announced its new proposal. The proposed standards would set the first uniform national standards for carbon pollution from future power plants. They will not apply to existing power plants. The proposal would set separate national limits for new natural gas-fired turbines and new coal-fired units.

These standards, which are proposed under Section 111 of the Clean Air Act, are based on an evaluation of the technology that is available to limit carbon pollution emissions at new power plants. EPA proposed these standards by following a well-established process to determine the ''best system of emission reduction, adequately demonstrated'' to limit pollution, otherwise known as BSER.

These proposed standards reflect the demonstrated performance of efficient, lower carbon technologies that are currently being used today. They set the stage for continued public and private investment in technologies like efficient natural gas and carbon capture and storage. The proposal was

published in the Federal Register on January 8, and the formal public comment period is now open. In fact, the EPA recently extended the comment period to May 9 to ensure that we get as much public input as practicable. We look forward to robust engagement on the proposal and will carefully consider the comments we receive as a final rule is developed.

As noted, the proposed rule would apply only to future power plants. For existing plants, we are engaged in extensive and vigorous outreach to a broad group of stakeholders, including States, who can inform the development of proposed guidelines. EPA expects to issue these proposed guidelines by June of this year.

These guidelines will provide guidance to States, which will have the primary role in developing and implementing plans to address carbon pollution from the existing plants in their States. We recognize that existing power plants require a distinct approach, and this framework will allow us to capitalize on state leadership and innovation while also accounting for regional diversity and providing flexibility.

Responding to climate change is an urgent public health, safety, national security, economic, and environmental imperative that presents great challenges and great opportunities. As the President and Administrator McCarthy have stated, both the economy and the environment must

provide for future and current--current and future generations. We can and we must embrace cutting carbon pollution as a spark for business innovation, job creation, clean energy, and broad economic growth.

The continued global leadership of the United States and the success of the Clean Air Act over the past 40 years make it clear that public health protection and economic growth go hand in hand.

Thank you again for the opportunity to testify, and I look forward to answering your questions.

[The statement of Ms. McCabe follows:]

********** INSERT 10 **********

Chairman SCHWEIKERT. Thank you, Ms. McCabe. And you just did that very efficiently.

And going over your testimony, can I drill down on just a couple of things I had some curiosities on? As you head towards, what is it, the May 9 ending of public comment--

Ms. MCCABE. Right.

Chairman SCHWEIKERT. --you actually had the discussion of demonstrated technologies, particularly as we speak of the A-CO2 standards. And some of this I know I am asking for sort of technical observation, but in the previous panel there was a lot of concern on the quality of demonstration, demonstration at capacity, demonstration at stress, demonstration of saline and other types of sequestration. Yet the rule set that you have produced basically in many ways is written as if the demonstration is done, that the technology is robust and ready to go, and yet the previous panel was pretty crisp even from right to left that there is still some real concerns on the technology itself. How do you do the rule set in that environment?

Ms. MCCABE. Well, that goes to the heart of the proposal, Mr. Chairman. We do believe that the proposal we put forward meets the requirements of the Clean Air Act for determining technology that is appropriate. And I want to clarify that what we do in a New Source Performance Standard is we set a performance standard, an expectation in the

amount of CO2 that these facilities can emit. We don't specify a particular technology. That is one of the beauties of how the Clean Air Act has worked over the years is that it provides room for innovation and flexibility and smart people, like you heard from the previous panel, finding better and less costly ways to do things.

But when it comes to the technology that we based those numbers on, we believe that if you look across all the information and data that is available, that there is adequate and robust data showing that the various components that we base that standard on are in use, have been in use, and will be ready--

Chairman SCHWEIKERT. But even in many of your own documents--and, look, this is just sort of an academic discussion I am trying to--there is discussions of demonstration projects but none of them are near the types of scales we are talking about with also the geographic, geological diversity. It is a little trucky--excuse me--it is a little tricky writing a rule set to something that is still I think a long way from scaled demonstration. And so it is just--it is one of my--it is just--from a personal concern, as we heard in testimony and then it was actually corrected by a couple of the other folks, almost all other clean air technologies that have been adopted had actually been around for years in some type of full scale before it

actually hit clean air rule sets.

Can I just walk through one other--and this is one I am genuinely trying to get a better--wrap my head around is we keep having the discussions that EOR may be one of the financing mechanisms of, you know, A-CO2 types of capture. But at the same time as we look at some of the discussions, what is it, RR? I will just refer to it as number six well regs. Doesn't this discussion over here dramatically change the economics of EOR and even just the discussion of it creates sort of a potential cost liability that even if you are going to say, hey, we are willing to sort of enter into these future agreements for an EOR capture mechanism, but all of a sudden if we end up in this new regulatory environment, we have just destroyed the economics of such type of agreement.

Ms. MCCABE. Well, there was a lot in your question, Mr. Chairman, so I will try to--I will go--

Chairman SCHWEIKERT. And sorry about that. It was just--it was a linear line of thought.

Ms. MCCABE. Yeah. No, I understand. Let me talk about the last part of your question first. The people are doing EOR. People have been doing EOR--

Chairman SCHWEIKERT. For decades.

Ms. MCCABE. --for decades very successfully. And though--the regulations that people have been speaking about,

the RR regulations had actually been around for a number of years as well and--

Chairman SCHWEIKERT. But like number six--

Ms. MCCABE. --people have been using them--

Chairman SCHWEIKERT. But has there ever been an--and I am sorry; I know I just interrupted and I hate it when I do that--an EOR which actually--where there is a number six sort of well standard?

Ms. MCCABE. Well--

Chairman SCHWEIKERT. Because something like that doesn't exist anywhere.

Ms. MCCABE. The number six well standard is for situations where people are injecting CO2 into the ground solely for the purposes of sequestering it there and leaving it there.

Chairman SCHWEIKERT. Okay.

Ms. MCCABE. EOR is a completely different application.

Chairman SCHWEIKERT. So EOR would fall more under the RR?

Ms. MCCABE. So that is the Class II well--

Chairman SCHWEIKERT. Okay.

Ms. MCCABE. --EOR.

Chairman SCHWEIKERT. So if I was doing EOR, I would be able to stay--you are telling me stay within Class II well standard and the RR enhanced regs side would not affect me?

Ms. MCCABE. No, the RR regulation--monitoring regulations do apply when an intent is to leave CO2 in the ground and it is intended to provide that additional information and assurance that the CO2 actually is remaining in the ground.

Chairman SCHWEIKERT. So if I did EOR but part of it was also as a capture mechanism, I would still at least--I would fall under the--

Ms. MCCABE. That is right.

Chairman SCHWEIKERT. --future monitoring?

Ms. MCCABE. That is right.

Chairman SCHWEIKERT. Okay. Thank you.

And with that, just because I know I am over time and you have some time restraints on you, hopefully we will get a second round.

Ms. Bonamici.

Ms. BONAMICI. Thank you very much, Mr. Chairman. Thank you, Ms. McCabe, for your testimony.

When you listened to the prior panel--and I have to say that there seems to be some mixing of the standards of adequately demonstrated and commercially available. I went back and looked at some of the discussion when Section 111 was implemented--when it was passed and implemented, and I found a discussion from the Senate Committee that says that it was designed to promote constant improvement in techniques

for preventing and controlling emissions from stationary sources, and an emerging technology used as the basis for standards of performance need not be in actual routine use somewhere.

And also a D.C. Circuit Court interpreted ''adequately demonstrated'' to be ''technically feasible'' stating that the section looks toward what may fairly be projected for the regulated future rather than the state-of-the-art at present since it is addressed to standards for new plants. So could you talk just a little bit about how this section has spurred technology development previously? And we heard some testimony before about if the regulation is there, that the technology is developed, but without that requirement, the technology is not. So if you could address that and then I have another question.

Ms. MCCABE. Sure. You are exactly right, and the history and the description that you have given of Section 111 is exactly what we understand the Clean Air Act and Congress to have intended, which is that technology will move and innovate when there is a requirement to do so. We heard a lot of discussion about that today.

But there are many examples going back through time where Section 111 was the mechanism that took emerging technologies and brought them into the mainstream. And in fact, there is--Mr. Chairman, I do have to take issue with

your comment a minute ago that in all prior 111 rules technology had been around for years. That is really not the case. One example I can cite for you is selected catalytic reduction technology, which is a NOx reduction technology, and it had been used in one type of application but it had never been used for industrial boilers.

Chairman SCHWEIKERT. To that point, actually, the catalytic converter--

Ms. BONAMICI. It is my time, Mr. Chairman.

Chairman SCHWEIKERT. I won't take it out of your time.

That catalytic conversion technology had been around a century, you know, using--you know, in the high temperature adjustments, maybe not in the way you described it, but it had been around for quite a long time.

Ms. MCCABE. It had not been used in this particular--and the particular sector--

Chairman SCHWEIKERT. But the basic technology has been around for decades and decades.

Ms. MCCABE. And similarly here we have technology that has been around for decades and decades and used in a variety of applications. So you do find that Section 111--and when these requirements are put in place, it does drive that technology development and then it becomes more widespread, the costs go down, and it becomes part of the mainstream.

Ms. BONAMICI. I wanted to ask you also--thank you for

your testimony--that you mentioned in your testimony that the EPA plans to issue proposed guidelines to lower carbon pollution from existing power plants by June of this year and that the Agency recognizes that existing power plants require a distinct approach. In fact, the EPA's website states that the standards that will be developed for currently operating sources are expected to be different from and less stringent than the standards proposed today for future sources. Can you please discuss EPA's process for developing guidelines for existing power plants and why the guidelines will be less stringent and more flexible than the standards for new plants?

Ms. MCCABE. Absolutely. We are operating under two distinct elements of the Clean Air Act here, and the Clean Air Act traditionally has had a very different approach to regulating existing sources. In fact, for the most part, existing sources are regulated under state plans, and that is exactly what will happen here.

So EPA's job here is to set guidelines for how the States will go about developing plans to address their own power plants. And the expectations for what would be appropriate technology for existing plants that are in place, that are located where they are, that have whatever remaining life they have are very, very different.

And, for example, and the Administrator has said this on

numerous occasions, we do not have any expectation that carbon capture and sequestration would form the basis for any expectation relative to existing plants.

Ms. BONAMICI. Thank you. And one more question. There has been some discussion today about the potential increase in cost if the carbon capture and storage rule is--when it is implemented. Can you talk about some of the costs associated with the lack of action to address climate change and increasing emissions? Thank you.

Ms. MCCABE. Yes. It is a very good question. There are costs to our economy and to society from the impacts that climate change are already having. In 2013 there were seven extreme weather events, which I think is kind of a nice way of saying great big huge horrible storms, that cost the economy over $1 billion each. And this is a real economic impact on our communities, on our families across the country.

Ms. BONAMICI. And healthcare costs might be--

Ms. MCCABE. And healthcare costs and disruption to families and to all communities.

Ms. BONAMICI. Thank you. I--my time is expired. I yield back.

Thank you, Mr. Chairman.

Chairman SCHWEIKERT. Thank you, Ms. Bonamici.

Chairwoman Lummis.

Mrs. LUMMIS. Thank you for being here, Ms. McCabe.

Are you here to testify then that these weather events absolutely were caused by climate change?

Ms. MCCABE. There--the scientific community has identified a number of impacts of climate change. Among those are increased intensity and frequency of weather events--

Mrs. LUMMIS. So are you sure that these specific weather events that you cite are caused by climate change?

Ms. MCCABE. I can't--I am not a meteorologist. I can't speak to any specific weather event and--

Mrs. LUMMIS. Thank you. Why is the EPA requiring a CCS analysis for new natural gas-fired units, including power plants, as well as boilers and heaters within manufacturing plants?

Ms. MCCABE. The EPA is proposing a performance standard for new fossil-fired power plants. We have one standard for gas and one standard for coal. Those standards are based on our review of the data that is available about what technologies are available for those plants to use going forward and--

Mrs. LUMMIS. Can you outline for us today the specific condition under which EPA would require CCS for either natural gas-fired utility units or non-utility boilers and heaters?

Ms. MCCABE. The rule does not require any specific technology. The rule sets a performance standard.

Mrs. LUMMIS. Well, why is the agency requiring this analysis?

Ms. MCCABE. We are not requiring anybody to do an analysis. We are setting a performance standard that new plants will need to meet--

Mrs. LUMMIS. Does CCS need guidance? Is it--is that the same thing? Are we speaking about the same thing?

Ms. MCCABE. Perhaps we aren't. I thought you were talking about the proposed New Source Performance Standards rule. Is that not correct?

Mrs. LUMMIS. That is correct.

Ms. MCCABE. Okay. The New Source Performance Standards rule, which is--we have a--we proposed last fall and is in the comment period now, addresses new, not-yet-built, not-yet-started coal and gas-fired power plants, and that rule sets a performance standard that the companies then will figure out how they will meet.

Mrs. LUMMIS. Wouldn't an EPA policy memorandum stating that CCS is not required for new natural gas plants reduce this regulatory uncertainty and help expedite permitting decisions?

Ms. MCCABE. For natural gas plants? The--

Mrs. LUMMIS. This is for EPA--you are requiring CCS

analysis for LNG facilities, too, correct?

Ms. MCCABE. Congresswoman, I think you may be talking about the Prevention of Significant Deterioration program.

Mrs. LUMMIS. Yes.

Ms. MCCABE. Okay. So that is a program that when new plants come in, require them to go through an analysis of what the best technologies are out there and then employ that as part of their project. And so that is what I think we are talking about here.

Mrs. LUMMIS. The distinction between EPA's analysis of best system for emission reduction for coal versus natural gas escapes me. Are there any pulverized coal projects you can cite like post-combustion CCS?

Ms. MCCABE. So there are several plants that have been using carbon capture--power plants that have been using carbon capture, for example, the Shady Point plant, the Warrior Run plant. There are also several plants that have been discussed today that are in construction that will be using this technology.

Mrs. LUMMIS. Are there any post-combustion natural gas projects?

Ms. MCCABE. Using CCS?

Mrs. LUMMIS. Yes.

Ms. MCCABE. Not that I am aware of.

Mrs. LUMMIS. What about pre-combustion CCS projects on

coal plants?

Ms. MCCABE. You are getting a little bit beyond my level of expertise, Congresswoman, but we would be glad to answer those questions for you after the hearing.

Mrs. LUMMIS. Okay. Thank you.

The President's budget includes 25 million to fund natural gas CCS projects. Now, if one of these projects becomes operational, would that be sufficient for EPA to begin requiring CCS as part of the NSPS or the PSD permitting process?

Ms. MCCABE. I think it would--those are very fact-specific determinations and we would have to take a look at the particular facts when and if that happened.

Mrs. LUMMIS. My time is expired. Thank you, Ms. McCabe.

I yield back.

Chairman SCHWEIKERT. Thank you, Mrs. Lummis.

Mr. Hall.

Mr. HALL. Thank you, Mr. Chairman.

Ms. McCabe, I feel a little guilty and that I have been here a long time and I was here when we passed the Clean Air and Clean Water, and knowing the oil and gas people, I felt, and most of us Republicans and Democrats alike felt that they needed some oversight and--but they also needed some federal help. And I do not find that they have been conducive to

fairness now in ordering a lot of companies to do things--to do the impossible and not give them time even to do the possible. And that is the major problem that I have seen, but I know that you are Acting Assistant Administrator, so you have been there several years, have you?

Ms. MCCABE. Yes, sir.

Mr. HALL. Okay. Well, then in the EPA's first New Source Performance Standard proposal in 2012 you were there. The EPA determined that carbon capture and storage technology was not the best system of emissions reduction for new coal power plants, correct? That is what it says. That is--

Ms. MCCABE. Yeah. That is the proposal that we withdrew, Congressman.

Mr. HALL. Well, I am getting to that. A year later in your latest proposal EPA says it is now the best system for emissions reduction. You just changed your mind overnight?

Ms. MCCABE. No, sir. We revised our proposal--

Mr. HALL. It took you a month or so to do it then?

Ms. MCCABE. No, sir. We revised our proposal based on the information that we had available to us at those points in the process.

Mr. HALL. Okay.

Ms. MCCABE. And we felt--and we got a lot of input on the first proposal and we felt that a different approach was the appropriate one given all of that information that we

obtained.

Mr. HALL. What has changed so dramatically in one year to allow the EPA to reach a different conclusion on the technical and economic feasibility of CCS?

Ms. MCCABE. We actually felt that the revised proposal provided a much clearer and more appropriate path for gas-fired facilities and coal-fired facilities, and that was the basis for our decision to change the proposal.

Mr. HALL. Well, I am just--I guess I was hoping that you could help me understand the EPA's position with respect to the Clean Air Act's requirement that it can only mandate the use of emissions reduction systems that have been ''adequately demonstrated.'' Would you agree, yes or no, that there isn't a single utility sailed power plant in the world currently operating with CCS?

Ms. MCCABE. Not--I am sorry. Can you repeat the last part of that?

Mr. HALL. Would you agree that there isn't a single utility sailed power plant in the world currently operating with CCS?

Ms. MCCABE. There are small facilities operating.

Mr. HALL. There are small--what do you--

Ms. MCCABE. There--

Mr. HALL. How do you distinguish that?

Ms. MCCABE. Well, there are a variety of sizes of

utility boilers and there are operating facilities that are small that are using this technology now.

Mr. HALL. Okay. Well, then would you agree, yes or no, that the law's requirement that a technology system be ''adequately demonstrated'' is past-tense, not future-tense? You are having a hard time with that one.

Ms. MCCABE. Well--

Mr. HALL. Do you want me to go onto the next one?

Ms. MCCABE. Well, no, sir. I would agree that the law requires that we look at technology that is in use and make a judgment based on whether that is feasible and available for the particular sector that the rule covers.

Mr. HALL. That it is adequately demonstrated?

Ms. MCCABE. That it is adequately demonstrated.

Mr. HALL. The Clean Air Act requires that the entire system of a new technology be adequately demonstrated, not just the individual components. How does EPA's decision to mandate that power plants employ a technology system that has never been fully and adequately demonstrated considered legal under the Clean Air Act? How can you justify that?

Ms. MCCABE. We believe that the system has been adequately demonstrated looking at the variety of applications that have been used and are in use and have been used for many years.

Mr. HALL. Well, maybe you can and this next--you can

provide any other example of a ''demonstrated'' technology required by EPA regulations where the technology was not used on a commercial basis?

Ms. MCCABE. The--our--the--our rule and the technical documents that accompany it go through all the examples of existing uses of the various technologies that we base of the rule on and we are happy to provide those to the--

Mr. HALL. Okay. Let me close. I have--just have 2 seconds left.

Ms. McCabe, at a hearing before the Energy and Commerce Committee on September 2011, Administrator McCarthy had this to say: ''I certainly don't want to give the impression that EPA is in the business to create jobs,'' one of the most cruel statements I have ever heard. Do you agree with the Administrator's statement?

Ms. MCCABE. I don't know--I am not familiar with that quotation. That is not how the Administrator feels. We are very concerned about--

Mr. HALL. It is just the way she talks--

Ms. MCCABE. --jobs that are created--

Mr. HALL. --but not the way she feels?

Ms. MCCABE. I wasn't there--

Mr. HALL. I know you weren't.

Ms. MCCABE. --Congressman. She is very concerned about--

Mr. HALL. I don't believe you would have said--

Ms. MCCABE. --jobs in this country.

Mr. HALL. --anything like that. I would like to think you wouldn't because I left her space to create that or to apologize for it or to say she was misquoted.

I yield back. I don't have time. Thank you.

Chairman SCHWEIKERT. Thank you, Mr. Hall.

Mr. Hultgren.

Mr. HULTGREN. Thank you, Chairman.

Thank you, Ms. McCabe, for being here today. It really is crucial that we on the Science Committee have a thorough understanding of the science behind the technological development necessary for your agency to accomplish the goals the President has set out.

While Administrator McCarthy has come before this committee touting science as the backbone of everything you do at EPA, I am worried that this has not been the case in regards to the technologies your agency is essentially mandating with your proposed regulations.

When designing the rule for the New Source Performance Standards, I assume EPA was in close consultation with the National Energy Technology Laboratory when deciding whether or not technology was adequately demonstrated. Was that the case?

Ms. MCCABE. Well, we do work closely with them but it

is EPA's job to make the determination about whether technology is adequately demonstrated. That is my--

Mr. HULTGREN. So there--and that specifically adequately demonstrated but there was not cooperation or consultation with the National Energy Technology Laboratory?

Ms. MCCABE. There was consultation and much discussion with them about the types of technologies that are out there and various scientific and technical discussions about them, but the determination within the law is EPA's to make.

Mr. HULTGREN. As of December 2012 NETL report on the Technology Readiness Assessment for clean coal research programs, NETL had 285 projects underway developing technologies related to CCS. Only one project had a TRL above 6 and 77 percent of the projects were at 4 or below. The only project above 6 was a regional carbon sequestration project that is not widely applicable across the United States.

The DOE fossil energy description of plant technology as TRL 6 is engineering scale models or prototypes are tested in a relevant environment. Pilot or process development unit scale is defined as being between 0 and 5 percent final scale. I wondered how did EPA reconcile the obvious differences between what you are calling adequately demonstrated and what the administrative agency charged with developing the technology has clearly defined as being at 5

percent or less of the final scale?

Ms. MCCABE. Well, there is a lot of information available about the types of technologies that we are talking about here, and in fact, the Secretary of Energy has indicated on many occasions that he is comfortable that this technology is available and ready for use and should be employed.

So these are all the kinds of discussions that we have with technical experts in and outside of government to make a determination about adequately demonstrated.

Mr. HULTGREN. Well, the frustration for us is there is a clear differentiation and it seems like ignoring many of those who should be listened to.

One of the reports that helped spur DOE to begin assessing technology readiness came from GAO, the title, ''Major Construction Projects Need a Consistent Approach for Assessing Technology Readiness to Help Avoid Cost Increases and Delay.'' While this report focused on the cost overruns and delays for DOE projects but did not assess whether or not a technology was ready before construction began, it only makes sense that the private sector would experience the same problems developing and integrating the vast amount of unready systems necessary for a commercially viable plant to begin operating.

My concern is that we are rushing this out before it is

ready at the detriment of long-term technological advancements and cost decreases. What evidence does EPA have showing that private sector is dealing with these cost increases and delays when developing and integrating unready technologies?

Ms. MCCABE. Well, Congressman, I think you are reflecting the history of the way technology has in fact developed under the Clean Air Act. And as we heard earlier, there are projects moving forward today where private sector commercial operations are competing essentially to provide this technology to projects going forward. So we are seeing it in the marketplace and this is the way technology develops. It is the way it developed with scrubbers; it is the way it developed with SCRs and many other examples of technology. It starts with a few projects and then it grows.

Mr. HULTGREN. For me it is a privilege to serve on the Science, Space, and Technology Committee. As I started questioning, talked about again how we have heard over and over again that science is the backbone of everything you do at EPA. Again, just from the few questions I have had and from what I have heard today, I think there are real concerns of that is not the case, that there are other agendas pushing ahead of what the science says. We are concerned about that. I want to get back to truly seeing science as the backbone

of everything EPA does.

With that, Mr. Chairman, I yield back.

Chairman SCHWEIKERT. Thank you, Mr. Hultgren.

Mr. Rohrabacher.

Mr. ROHRABACHER. Thank you very much.

Mr. Chairman, yeah, it is important that we get our science right here because what we are doing is mandating costs and mandating, how do you say, goals that our business has to achieve in order to provide services and products and jobs for our people.

Let me just note that for the record, Mr. Chairman, I would like to put in for the record an article by Professor Matt Collins of the United Kingdom's Meteorological Office, a professor at Exeter University, suggesting that his analysis that there is no evidence to suggest that weather is any more ferocious or frequent than it ever has been in the past. I would like to put that into the record at this point.

Chairman SCHWEIKERT. Without objection.

[The information follows:]

********** COMMITTEE INSERT **********

Mr. ROHRABACHER. So we see and we also heard earlier about 97 percent of the scientists that quoted again and of course, as I suggested during the last time I had a chance to ask questions, that was 97 percent--it was being presented as--to us as 97 percent of all the scientists is actually 97 percent of the scientists who replied to a questionnaire in which the people who were asked were actually decided upon and then it was just the people who replied to the questionnaire, much less 97 percent of all scientists.

You don't believe that 97 percent of all scientists agree with the manmade global warming theory, do you?

Ms. MCCABE. Congressman, there is overwhelming support in the scientific community--

Mr. ROHRABACHER. I had--that is not my question. The 97 percent that we hear, overwhelming could be 60 percent, could be 50 percent. I don't even believe it is overwhelming, but you don't believe it is 97 percent, do you?

Ms. MCCABE. I don't know that it is helpful to talk about--

Mr. ROHRABACHER. Well, I am asking you a question.

Ms. MCCABE. Right.

Mr. ROHRABACHER. Do you believe that this is clear--this 97 percent figure is thrown at us all the time. You don't believe that, do you?

Ms. MCCABE. I don't believe it or disbelieve it,

Congressman.

Mr. ROHRABACHER. You don't want to answer the question, do you?

Ms. MCCABE. No, it is just--it is not a--

Mr. ROHRABACHER. Why can't you answer the question then? I am asking you whether you believe that this figure that is presented to us as the 97 percent an accurate or inaccurate figure?

Ms. MCCABE. Ninety-seven percent of the studies on this issue conclude that climate change is real and happening.

Mr. ROHRABACHER. That wasn't my question. My question was do you believe that 97 percent of the scientists believe that global climate change is happening because of human activity?

Ms. MCCABE. Well, the premise of your question, the 97 percent--

Mr. ROHRABACHER. Okay.

Ms. MCCABE. --doesn't come from--

Mr. ROHRABACHER. Okay.

Ms. MCCABE. --number of individual scientists; it comes from the number of studies.

Mr. ROHRABACHER. Okay. So in other words, the people who have been throwing the 97 percent figure at us have been wrong?

Ms. MCCABE. I don't know who has been saying what--

Mr. ROHRABACHER. Well, we just heard it earlier, didn't we, in this--so you weren't listening to the--

Ms. MCCABE. I was--

Mr. ROHRABACHER. All right. All right.

Ms. MCCABE. --listening.

Mr. ROHRABACHER. Okay. You don't want to answer that question. I got it.

Well--and you believe then that the weather is more ferocious, this--I just put a very reputable scientist who obviously doesn't agree that it--with you. He is probably not part of that 97 percent of that you don't want to comment on. Do you believe that the weather now is more ferocious and do you disagree with that scientist's findings?

Ms. MCCABE. I am not familiar with that particular study so I don't want to speak to it in particular. I am also not a climate scientist myself--

Mr. ROHRABACHER. All right.

Ms. MCCABE. --so I don't want to hold myself out as an expert on that, but I pay attention to--

Mr. ROHRABACHER. Okay. Now, with that said, if all of your--all of the mandates that we are talking about and the change in regulation that we are talking about happen, I take it it is--and we keep hearing that it is motivated on trying to say that climate and this--change the climate of the planet to make sure that we aren't changing the climate of

the planet, how much effect on the climate of the planet will these regulations have?

Ms. MCCABE. So these regulations are intended to control the amount of CO2 that is emitted--

Mr. ROHRABACHER. Right.

Ms. MCCABE. --by future power plants. We know that CO2--

Mr. ROHRABACHER. Um-hum.

Ms. MCCABE. --is a key contributor to what is happening in the climate and that we must reduce the amount of CO2 in the atmosphere in order to have an impact.

Mr. ROHRABACHER. Um-hum.

Ms. MCCABE. This is a global pollutant.

Mr. ROHRABACHER. Right.

Ms. MCCABE. It is a global problem.

Mr. ROHRABACHER. Right.

Ms. MCCABE. There are many, many sources of it. These are significant sources of it and--

Mr. ROHRABACHER. So there will be a significant change in our climate if we follow these new guidelines, is that correct?

Ms. MCCABE. These guidelines are an important part of an effort in this country and globally to make the kind of changes that are needed to address climate change.

Mr. ROHRABACHER. Okay.

Ms. MCCABE. You will not be able to--

Mr. ROHRABACHER. That is a good way not to answer the question. How much effect will it have on the climate?

Ms. MCCABE. You will--no individual rule will be able to be traced--

Mr. ROHRABACHER. Very little--

Ms. MCCABE. --because this is--

Mr. ROHRABACHER. So it will have very little impact--

Ms. MCCABE. It is--

Mr. ROHRABACHER. --is that right--

Ms. MCCABE. It is an--

Mr. ROHRABACHER. --if any?

Ms. MCCABE. It is an important aspect of the effort to reduce CO2 globally.

Mr. ROHRABACHER. All right. Again, you don't want to answer the question.

Listen, I--when I ask a question in a debate, I am willing to debate the things that I disagree with. You have dodged almost every question that I have asked you. I am sorry. That is not the way we should be handling ourselves here.

But with that said, I think there is an honest disagreement as to whether human activity is changing our climate. It is an honest disagreement. We need to be more forthright and willing to actually confront the points being

made by each side of this debate, and I don't think you have been that way with us today.

Thank you very much.

Chairman SCHWEIKERT. Mr. Cramer.

Mr. CRAMER. Thank you, Mr. Chairman. Thank you, Ms. McCabe, for your testimony, for being with us, and for--during this long morning into the afternoon.

There was some confusion I sensed when Chairman Hall asked about current use or current demonstrations of CCS. How many coal plants use carbon capture now, coal-fired electricity plants?

Ms. MCCABE. So I actually don't add these up. Do we have a number?

Mr. CRAMER. Can you name some? Could you name some?

Ms. MCCABE. Yeah. Yeah. So the Warrior Run power plant, the Shady Point power plant, there is a power plant in Germany called to the Vattenfall Schwarze power plant.

Mr. CRAMER. Do you know what the average size or how much--how many megawatts they produce?

Ms. MCCABE. I don't have that information with me, Congressman, but we can get it for you.

Mr. CRAMER. Okay. Because I have to be honest. Now, I am going to respect the Ranking Member who has very effectively tried to discern the difference between adequate demonstration and commercially available, and yet without

something being commercially available, I don't know how you demonstrate it. In other words, if it is not being done at a commercial level, at a level that would be equivalent to what we are asking here and what we are suggesting in terms of new power plants, it is hard for me to comprehend how it has been adequately demonstrated. But I respect the difference.

How are we going to determine whether something is adequately demonstrated if it is not commercially deployed at the scales that we are applying the rule to?

Ms. MCCABE. Right. Well, I think that is the debate that is concerning the Committee here. The Clean Air Act does not use the term ''commercially available.'' It uses the term ''adequately demonstrated.'' And as Congresswoman Bonamici cited some of the history of that section and the way it has been applied, it has been--it was clear that Congress intended for this provision to be--to put the United States on the forefront of developing technologies. And so it is not an expectation that technology be wide--in widespread use, and that has been clearly demonstrated over the years.

Mr. CRAMER. But in the most recent proposal, you actually do state that carbon dioxide emissions from new power plants are--from CCS has not been implemented and that we believe there is insufficient information to make a determination, that--these are quotes from the EPA's proposed

rules regarding technical feasibility. It seems to me that the same exact thing applies here to coal, that if it has not been done with CCS--or with combined cycle, it has not been done with coal, why the difference?

Ms. MCCABE. Well, there is a difference. There is a difference in the information that is available and there is a significant difference in the ways in which these technologies are deployed and are being used in the coal versus natural gas situations. There are also technical differences between the operations of those plants where we do not have information on the natural gas side that we do on the coal side, and that is the basis of our proposal.

Mr. CRAMER. As you know, in order for this--if we had the carbon capture technology and if it was adequately demonstrated and it became commercially available and it was economically feasible to do it and--to meet the growing demand--by the way, in North Dakota where I live and where I was once a regulator, we have a demand of over 2,000 megawatts right now that is being unmet to meet the growing economy that we have as a result of our more reasonable regulatory touch I might add.

But the EPA has specifically cited the North Dakota Weyburn CO2 pipeline from the--

Ms. MCCABE. Um-hum.

Mr. CRAMER. --great Synfuels plant--

Ms. MCCABE. Yeah.

Mr. CRAMER. --Great Plains Synfuels plant, which I was just at a week ago Friday with the Administrator.

Ms. MCCABE. Yeah.

Mr. CRAMER. We had a very good meeting there. But that requires an international pipeline. You perhaps heard me discuss it earlier today. This is day 2,000 of the Keystone XL pipeline's review process. Is the--and which the EPA has largely criticized and opposed, continues to throw up sort of barriers I guess. Is EPA prepared to, you know, support CO2 pipelines all over the country and perhaps even across international lines?

Ms. MCCABE. There are CO2 pipelines across the country and we are--

Mr. CRAMER. I am very familiar with that--

Ms. MCCABE. Yeah. Yeah.

Mr. CRAMER. Yeah.

Ms. MCCABE. And we believe that that is an important part of moving this technology forward and putting in place things that will be able to take carbon dioxide out of the air.

Mr. CRAMER. I just hope the EPA is this cooperative when it actually comes time to siting some of these CO2 pipelines should we need to get them to market.

I am just going to wrap up, Mr. Chairman, by saying that

the EPA also notes that natural gas prices--and they have claimed natural gas prices have been the real determining factor in the marketplace, and yet we are--here we are coming off of the winter where PJM actually had to seek relief from FERC from its $1,000 per megawatt hour price cap because natural gas prices spiked as a result of a cold winter. It is a very volatile fuel. I support it but I don't think we should displace coal with it.

Mr. BRIDENSTINE. [Presiding] The gentleman yields back.

Mr. Weber from Texas.

Mr. WEBER. Thank you, Mr. Chairman.

Ms. McCabe, should the President issue a red line on CO2 emissions? Would that help?

Ms. MCCABE. I am not sure I understand your question.

Mr. WEBER. Well, when he declares that there is a red line--or would that further erode the Administration's capability in a, pardon the pun, storm of controversy? It seems like the global warming religion has been bought into hook, line, and sinker by this Administration. We--you talk about the Administration's credibility and EPA's credibility. Are you aware of the three fracking cases where they issued a statement to the fact that they had contaminated water in three areas of the country here--some--a year or two back? Are you familiar with those three cases?

Ms. MCCABE. I am not sure I know specifically what you are referring to.

Mr. WEBER. Okay. But you are aware that it did happen?

Ms. MCCABE. I am aware that there have been issues related to--

Mr. WEBER. Right, and they had to retract their statement that in fact fracking had contaminated three areas of drinking water?

Ms. MCCABE. I am actually not familiar with the specific statements that you are--

Mr. WEBER. Well, I am glad--

Ms. MCCABE. --referring to.

Mr. WEBER. --I can inform you of that today. That makes me feel like today was in some fashion worthwhile.

You mentioned in your prepared remarks--I have got a copy of it here in front of me--that you would like to be able to--that EPA would like to be able to approach on--I am sorry--that you would be able to capitalize on State innovation in dealing with these regulations. And if you look up the word capitalize, there are a couple different definitions. It says take advantage of, turn something to one's advantage, and then the other one is supply with capital, as in dollars and cents. And you were, I think, in the backroom watching the previous panel, is that right?

Ms. MCCABE. Yes.

Mr. WEBER. You--I don't know if you saw my comments about the carbon capture and sequestration and storage facility in my district in Port Author by Air Products where it was a 400 and something million dollar project, but the EPA--or the DOE rather supplied 66 percent of the funding. You are aware of that project?

Ms. MCCABE. I am aware of the project and I heard your statements earlier.

Mr. WEBER. Okay. And you don't disagree with what I said in that regard?

Ms. MCCABE. I don't have independent knowledge of the amount.

Mr. WEBER. Okay.

Ms. MCCABE. I will take your word for it.

Mr. WEBER. But it sounds reasonable. So in Texas we have been doing enhanced oil recovery for about 40 years, as was alluded to by our colleague on the left, Marc Veasey, earlier. And we do a good job of it. And so you want--in your earlier comments, you said you wanted to capitalize on the stakeholder input and the States', I guess, experience. Texas has a great, great history of experience in EOR and in producing an economy that is arguably the 11th largest in the world if it was a country. Why wouldn't you want to follow Texas' model when it comes to enhanced oil recovery, when it comes to air quality permitting? I realize that is--we are

in a little bit different realm there--

Ms. MCCABE. Um-hum.

Mr. WEBER. --but why won't the EPA acquiesce to following the TCEQ in Texas? Do you have any knowledge about that?

Ms. MCCABE. Well, our job under the Clean Air Act when it comes to setting standards for new--

Mr. WEBER. Um-hum.

Ms. MCCABE. --power plants is to do that, is to set standards for new power plants. What I was referring to in my testimony was the provisions dealing with existing power plants where we do very much intend to look to States that have been--

Mr. WEBER. Thirteen hundred people a day are moving to Texas. We have created more jobs than the other lesser 49 States in many years combined--

Ms. MCCABE. Um-hum.

Mr. WEBER. --and we are the country's leading state exporter of products for like 11 years running. We get it in Texas. Less onerous government regulations, we have got wide-open spaces with clean air and great drinking water, and so I hope that you will--the EPA will really take that into account and follow Texas' model on that.

Do you--are you here today to testify that you think that what was done at the Air Products plant in Port Arthur,

Texas, a $400 million project with 66 percent government funding, that that proves and demonstrates that this is a viable project to be done or a process in business? Are you here to testify to that?

Ms. MCCABE. Sir, I am here to speak about our proposal, which is based on a variety of information, not any--

Mr. WEBER. And do you think that that is--

Ms. MCCABE. --one single project.

Mr. WEBER. But--all right. Well, can you tell me of another carbon capture and sequestration storage facility that is that big or of that magnitude?

Ms. MCCABE. Well, there is--I am not as familiar with the specifics of that project as you are certainly, but there are places where carbon is being injected into the ground. There is lots and lots of EOR going on everywhere around the country and indeed around the world--

Mr. WEBER. So you don't have an opinion about whether that adequately demonstrates this as a duplicative process?

Ms. MCCABE. I do have an opinion that we set forth in our proposed rule that when you look at all of this information that is available, all the projects that are out there, that we do believe that the technology has been adequately demonstrated to support the performance standard--

Mr. WEBER. Well, would you--

Ms. MCCABE. --that was proposed.

Mr. WEBER. --agree with the fact that the technology to put a man on the moon has been adequately demonstrated?

Ms. MCCABE. Adequately demonstrated is a legal term within the meaning of the Clean Air Act--

Mr. WEBER. Well, let me--

Ms. MCCABE. --and I wouldn't want to apply it--

Mr. WEBER. --put it this way. Did we put a man on the moon?

Ms. MCCABE. We did.

Mr. WEBER. Okay. But you would not want to mandate that all airlines need to have that technology, putting a man on the moon, right?

Ms. MCCABE. With respect, Congressman, I am not sure it is a valid analogy--

Mr. WEBER. Well, what I am saying is you are taking this plan based on the funding and the model that was done in the Air Products plant and you are saying that that adequately demonstrates that it ought to be in rules.

Ms. MCCABE. I am saying that the whole body of information that we have is--supports a finding that the technology has been adequately demonstrated--

Mr. WEBER. And the EPA never takes funding into account, do they, the cost?

Ms. MCCABE. We do take cost into account, very much we do. And as our documents show underlying the rule, the

cost--should I finish?

Chairman SCHWEIKERT. Please finish--

Ms. MCCABE. Okay.

Chairman SCHWEIKERT. --your thought.

Ms. MCCABE. The cost of building a new coal plant with all the technology that we have looked at, partial capture and sequestration is comparable with other non-natural gas-powered--

Mr. WEBER. Well, we are going to have to disagree.

Thank you, Mr. Chairman.

Chairman SCHWEIKERT. Thank you, Mr. Weber.

And Arizona is getting about 350 people a day, so--but we are a lot smaller.

Mr. Bridenstine.

Mr. BRIDENSTINE. Thank you, Mr. Chairman.

I had a couple of thoughts and questions. Over the past several months, we have seen a troubling trend of the EPA deliberately avoiding transparency and accountability. When members of EPA's own Science Advisory Board raised serious questions about the NSPS rule, astonishingly, the Agency claimed that storage is beyond the scope of this rule. In other words, the EPA wants people to believe that carbon capture and storage systems don't have to consider where the carbon goes and neither does the Agency. It is misleading and dangerous for the EPA to quietly dismiss inconvenient

facts. Do you agree?

Ms. MCCABE. We--I have to disagree with the premise of your question, Congressman. We very much respect the role of the SAB. We engaged with them in a very open process. All the conversations we had with them were completely open to the public and on the record.

Mr. BRIDENSTINE. Okay. I would like to submit this letter for the record. This is a letter from the EPA's Science Advisory Board. I will just read one sentence here, actually, a couple sentences. It says, ''the portion of the rulemaking addressing coal-fired power plants focuses on carbon capture and that the regulatory mechanisms for addressing potential risks associated with carbon sequestration''--carbon capture--''are not within the scope of the Clean Air Act.'' And this is the advisory board.

''Carbon sequestration, however, is a complex process, particularly at the scale required under this rulemaking, which may have unintended multimedia consequences. The Board's strong view''--the Board's strong view--''is that a regulatory framework for commercial-scale carbon sequestration that ensures the protection of human health and the environment is linked in import systematic ways to this rulemaking.'' This letter has been submitted in the record.

Even though the EPA officials sought to, you know,

obviously not take this into account, the EPA science advisors continue boldly to call for a thorough review of the science in this--the science underlying this rule. Will you commit to me today that you will heed your own science advisors and await a full review of the serious concerns raised by the Science Advisory Board before finalizing this rule?

Ms. MCCABE. We will of course work with our Science Advisory Board, but what I will reflect to you, Congressman, is what the Board recognized was that within the four corners of this proposed rule, the regulatory approach and the--the sequestration and storage is not within the four corners of this rule; it is addressed in other regulatory programs--

Mr. BRIDENSTINE. So real quick--

Ms. MCCABE. --that have been mentioned today.

Mr. BRIDENSTINE. --the law doesn't require the Agency to examine non-air environmental consequences of CCS systems?

Ms. MCCABE. That is a provision of the law.

Mr. BRIDENSTINE. Okay. But it is not a provision of what you deem appropriate in this rule?

Ms. MCCABE. No, not at all. Not at all. I was trying to clarify that the Science Advisory Board recognized that sequestration, underground injection of carbon, is addressed in other regulatory programs, not in this one.

Mr. BRIDENSTINE. Okay. Does the Agency consult with

the U.S. Fish and Wildlife Service to determine if this rule would impact, endanger, or threaten species?

Ms. MCCABE. We have not consulted with the U.S. Fish and Wildlife on this provision.

Mr. BRIDENSTINE. Do you intend to?

Ms. MCCABE. We are--we will apply--we will comply with all applicable requirements, including that one if it is deemed to be applicable here.

Mr. BRIDENSTINE. So, again, will you commit to me that you will not go forward with this rule until you have, you know, examined the environmental consequences for non-air, you know, parts of the environment?

Ms. MCCABE. I will commit to you that before we finalize this rule, we will assure ourselves that we have satisfied all the legal requirements associated with this particular rulemaking.

Mr. BRIDENSTINE. Although I understand the proposal does not currently require carbon capture and storage for gas or oil power, can you assure me that the Agency will not consider requiring CCS for gas-fired power plants in the future?

Ms. MCCABE. We do not have a factual basis that suggests that that is an appropriate thing, which is why we did not include it in this rule.

Mr. BRIDENSTINE. Can you assure me that the Agency will

not consider requiring CCS for gas-fired power plants in the future?

Ms. MCCABE. We do not have present plans to move in that direction.

Mr. BRIDENSTINE. Can you assure me that the Agency will not consider requiring CCS for gas-fired power plants in the future?

Ms. MCCABE. I can't commit the Agency indefinitely into the future, Congressman. I can tell you where we are right now and we do not foresee that.

Mr. BRIDENSTINE. One other thing that I think is important, you know, there is potentially the application of the new SPS standards or similar assumptions of reasoning to existing plants that are modified and reconstructed. Can you assure me that the Agency will not require CCS for modified and reconstructed coal-fired power plants?

Ms. MCCABE. That is a rule that will come out as a proposal later this spring, and that rule will lay out what the expectations are that are there. I will tell you that we are looking at those facilities which are existing in a different way than we look at brand-new un-built power plants.

Mr. BRIDENSTINE. You mentioned one project that was a--that is in Oklahoma, Sandy Point, as one of the projects that is a demonstration of the capability in the technology.

How many of these projects are there?

Ms. MCCABE. I cited three.

Mr. BRIDENSTINE. Are they all power plants?

Ms. MCCABE. Those three are power plants. So the three I cited are power plants. There are many other industrial applications of the technology as well, but I was asked specifically about power plants.

Mr. BRIDENSTINE. And, for the record, can you submit what the current size and the status of those power plants are? My time is expired.

Ms. MCCABE. Sure. We will follow up with that information.

Chairman SCHWEIKERT. Thank you, Mr. Bridenstine.

You have--you had requested a UC for--there are only two of us so I guess there is no objection.

[The information follows:]

********** INSERT 19 **********

Chairman SCHWEIKERT. It is always wrong when you object to your own Member. Yeah.

Give me just a couple seconds. I want to make sure that we touched on--there are a couple other externalities that I wanted to make sure we had touched on.

I may submit a couple other more technical questions to you in writing.

Ms. MCCABE. Sure.

Chairman SCHWEIKERT. I appreciate--I know these are always sometimes mentally taxing and the preparation that goes into it.

This is the first time I have ever said this in my short time here in Congress. I was--I am a little disappointed at some of the intellectual capital we have shared because I was somewhat hoping to do something much more technical on where are we really on the science. What is the--you know, I come from the world--the law of unintended consequences is when we don't think things through--how many major projects have we all stepped into, we have watched our government and industry step into and we are here a few years from now and we go we missed that.

You know, if we were holding this hearing 12 years ago, part of your opening would have been about peak oil and the world running out of energy and fossil fuels, and today, we know we had our data absolutely wrong. And how do we make

major decisions like this that have a series of economic effects and hopefully environmental effects and make sure we are doing it in the most technically rational, thought-out, disciplined, and properly economically incentivized fashion? And so hopefully we can send you over some more questions and some of your team can respond to them.

And with that, I want to thank you for your testimony and do be prepared that the Members may have additional questions for you. And we will ask you to respond to those in writing. The record will remain open for a couple weeks for additional comments and written questions from Members.

And with that, thank you for participating with us today.

Ms. MCCABE. Thank you, Mr. Chairman. We will be happy to follow up--

Chairman SCHWEIKERT. And with that, the--

Ms. MCCABE. --with any questions.

Chairman SCHWEIKERT. And with that, the hearing is closed.

[Whereupon, at 1:01 p.m., the Subcommittees were adjourned.]

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SPEAKER LISTING

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LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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EPA's Carbon Plan: Failure by Design

Wednesday, July 30, 2014
10:00 a.m.-12:00 p.m.
2318 Rayburn House Office Building

Witnesses

The Honorable Jeffrey Holmstead, Partner, Bracewell & Giuliani LLP

The Honorable Charles McConnell, Executive Director, Energy & Environment Initiative, Rice University

Dr. David Cash, Commissioner, Massachusetts Department of Environmental Protection

Mr. Gregory Sopkin, Partner, Wilkinson, Barker, Knauer LLP

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
FULL COMMITTEE

HEARING CHARTER

EPA's Carbon Plan: Failure by Design

Wednesday, July 30, 2014
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

PURPOSE

The Committee on Science, Space, and Technology will hold a hearing entitled *EPA's Carbon Plan: Failure by Design* on Wednesday, July 30th, in Room 2318 of the Rayburn House Office Building. The hearing will examine the Environmental Protection Agency's (EPA) approach to implementing technology-based standards under section 111 of the Clean Air Act (CAA). In so doing, the hearing will examine the scientific methods employed by EPA to calculate each state's specific carbon-reduction goal; the technologies available to meet EPA's standards for fossil-fuel power plants; and technical challenges to implement EPA's carbon plan.

WITNESS LIST

- **The Honorable Jeffrey Holmstead**, Partner, Bracewell & Giuliani LLP
- **The Honorable Charles McConnell**, Executive Director, Energy & Environment Initiative, Rice University
- **Dr. David Cash**, Commissioner, Massachusetts Department of Environmental Protection
- **Mr. Gregory Sopkin**, Partner, Wilkinson, Barker, Knauer LLP

BACKGROUND

Following the Supreme Court's 5-4 decision in *Massachusetts v. EPA*,[1] the Agency promulgated numerous standards and proposed rules aimed at reducing greenhouse gas (GHG) emissions. These include EPA's:

- 2009 *Endangerment Finding*, where "EPA determined that greenhouse gases endanger the health and welfare of Americans;"[2]

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[1] Massachusetts v. U.S. Environmental Protection Agency, 549 U.S. 497 (2007) *available at* http://www.supremecourt.gov/opinions/06pdf/05-1120.pdf.

[2] U.S. ENVIRONMENTAL PROTECTION AGENCY. "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule." Dec. 2009. A*vailable at* http://www.gpo.gov/fdsys/pkg/FR-2009-12-15/pdf/E9-29537.pdf.

- *Light Duty Vehicle Rule*, in which "EPA coordinated with the National Highway Traffic Safety Administration to develop harmonized regulations to reduce greenhouse gas emissions and improve the fuel economy of light-duty vehicles;"[3] and
- *Tailoring Rule*, where "EPA set greenhouse gas emission thresholds to define when permits under the New Source Review Prevention Significant Deterioration (PSD) and title V Operating Permit programs are required for new and existing industrial facilities."[4]

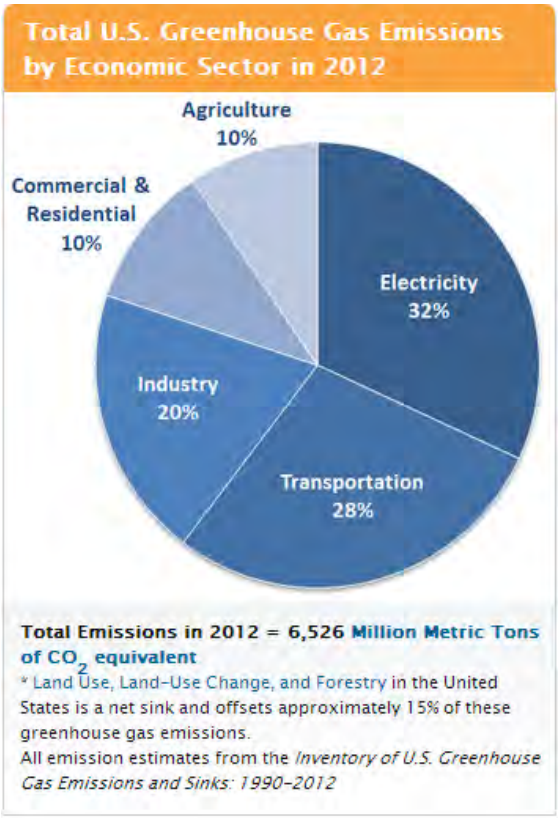


Figure 1. Source: U.S. EPA *Available at* http://www.epa.gov/climatechange/ghgemissions/sources.html

Climate science—and regulatory actions informed by such science—are among the most complex and controversial issues facing policymakers. President Obama has increasingly signaled his intention to propose significant, new executive actions and regulatory measures aimed at addressing climate concerns.[5]

According to EPA, power plants are the Nation's largest source of carbon pollution and "account for roughly one-third of all domestic greenhouse gas emissions in the United States."[6] (See Figure 1) On June 25, 2013 President Obama directed the Environmental Protection Agency (EPA) to regulate greenhouse gas emissions from new and existing power plants.[7]

REGULATORY CONTEXT

Section 111 of the Clean Air Act (CAA) establishes a unique technology-based mechanism for controlling emissions from "stationary sources" (i.e., power plants). Section 111 provides authority for EPA to promulgate standards which apply to new and modified sources. Specifically, EPA is directed to set standards based on "the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into

[3] U.S. ENVIRONMENTAL PROTECTION AGENCY. "Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards; Final Rule." May 2010. *Available at* http://www.gpo.gov/fdsys/pkg/FR-2010-05-07/pdf/2010-8159.pdf.

[4] *See e.g.* U.S. Environmental Protection Agency. "Prevention of Significant Deterioration and Title V Greenhouse gas Tailoring Rule Step 3 and GHG Plant wide Applicability Limits; Final Rule" July 2012. *Available at* http://www.gpo.gov/fdsys/pkg/FR-2012-07-12/pdf/2012-16704.pdf.

[5] See: http://www.whitehouse.gov/the-press-office/2013/06/25/remarks-president-climate-change and http://www.whitehouse.gov/climate-change for examples.

[6] http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/5bb6d20668b9a18485257ceb00490c98!OpenDocument

[7] THE WHITE HOUSE, *"The President's Climate Action Plan,"* June 2013. *Available at* http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

account the cost. . .) the Administrator determines has been adequately demonstrated."[8] In setting the standard, EPA is given some flexibility in that "emission limits may be established either for equipment within a facility or for an entire facility."[9]

Section 111 lays out different approaches for new and existing sources. Under Section 111(b), the EPA has the authority to develop a "federal program to address new, modified and reconstructed sources by establishing standards of performance."[10] In contrast, EPA explains that "section 111(d) of the Act requires states to develop plans for *existing* sources of noncriteria pollutants (i.e., a pollutant for which there is no national ambient air quality standard) whenever EPA promulgates a standard for a new source."[11]

New Power Plants

EPA first proposed a New Source Performance Standards (NSPS) for emissions for carbon dioxide (CO2) from power plants in April 2012. However, after more than 2.5 million comments on the original proposal, EPA decided that a new approach was warranted and rescinded the original proposal.[12] Consequently, on September 20, 2013 Administrator Gina McCarthy announced EPA's re-proposed CO2 NSPS for new fossil fuel-based electric generating units (EGUs).

Under EPA's NSPS proposal, the Agency concluded that Carbon Capture and Storage (CCS) has been adequately demonstrated as a technology for controlling CO2 emissions in full-scale commercial applications at coal-fired EGUs, while reaching the opposite conclusion—that CCS is not adequately demonstrated—in the case of gas-fired EGUs. Based on this determination, EPA proposed an emissions limit for coal-fired sources of 1,100 lb CO2/MWH and proposed standards for natural gas combined cycle sources from 1,000 to 1,100 lb CO2/MWH depending on the size and type of unit. EPA did not include modified and reconstructed plants in the proposed rule. EGUs that primarily fire biomass are exempted from the proposed rule.[13] Find more information on CCS and EPA's carbon rules in hearing held last March: http://science.house.gov/hearing/subcommittee-energy-and-subcommittee-environment-joint-hearing-science-capture-and-storage.

Existing Power Plants

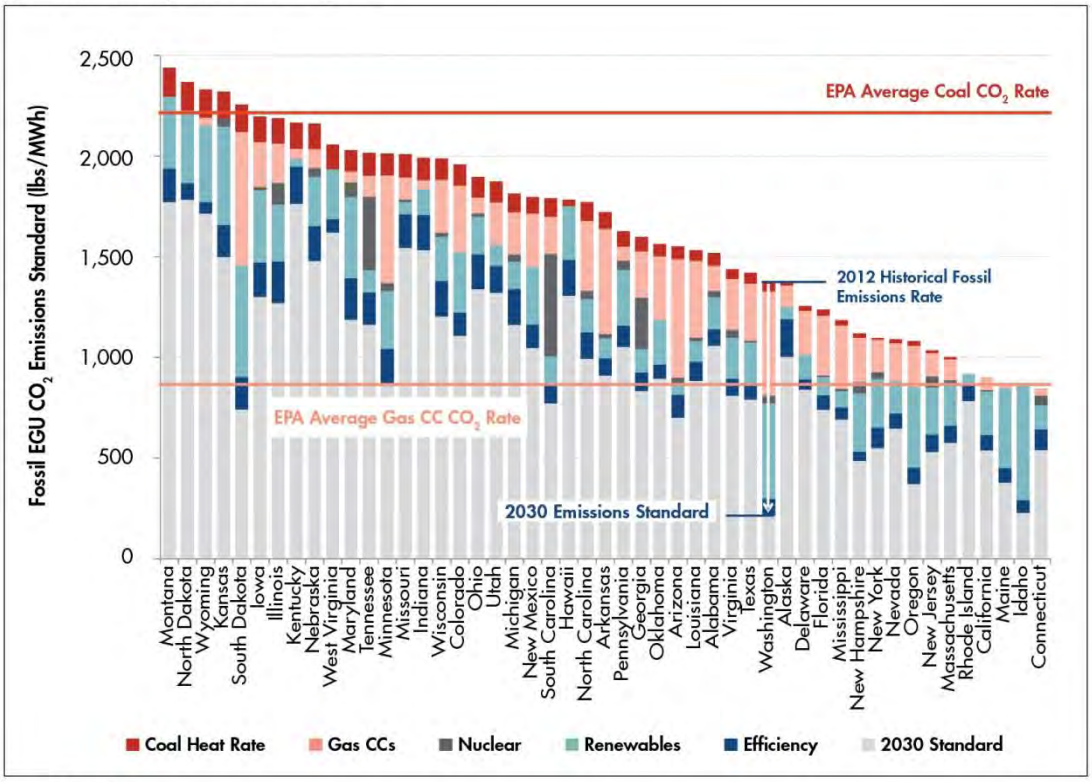
On June 2, 2014, EPA issued its "Clean Power Plan" under section 111(d), which addressed carbon emissions from existing fossil-fueled power plants. EPA explains the key difference between section 111(d), for existing power plants, and 111(b) for new and modified plants: "Section 111(d)'s mechanism for regulating existing sources differs from the one that

[8] Clean Air Act § 111(a)(1), 42 USCA § 7411(a)(1) (2006).
[9] http://www2.epa.gov/sites/production/files/2013-09/documents/111background.pdf
[10] http://www2.epa.gov/sites/production/files/2013-09/documents/20130920technicalfactsheet.pdf
[11] http://www.epa.gov/Region7/air/rules/111d.htm.
[12] Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, Proposed Rule, Preamble p. 14-5, Sep. 20, 2013. Found at: https://www.federalregister.gov/articles/2014/01/08/2013-28668/standards-of-performance-for-greenhouse-gas-emissions-from-new-stationary-sources-electric-utility#h-18 **(Is this the right link for this citation?)**
[13] *Id.* at 30, fn. 8.

CAA section 111(b) provides for new sources because CAA section 111(d) contemplates states submitting plans that establish 'standards of performance' for the affected sources and that contain other measures to implement and enforce those standards."[14]

The Agency believes the proposed Clean Power Plan will "lower the carbon intensity of power generation in the United States by approximately 30% in 2030 from carbon dioxide emissions levels in 2005. The agency predicts that under the Clean Power Plan, electricity bills will decline by "roughly 8 percent"[15] and that the amount of U.S. electricity generated by coal-fired EGUs will decline by at least 25%. To achieve this goal, EPA is giving each state a numerical carbon reduction target, based on the state's existing power generation portfolio."[16] (See Figure 2.)

Figure 2: Fossil EGU CO_2 emissions standards by state



Source: The Brattle Group

Specifically, EPA set each state's required level of carbon reduction assuming that each state could recognize a set level of carbon reductions through the use of four "building blocks." Broadly speaking, the four blocks encompass:[17]

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[14] U.S. ENVIRONMENTAL PROTECTION AGENCY, *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, Proposed Rule, 79 FR 34832, June 2, 2014.

[15] http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/5bb6d20668b9a18485257ceb00490c98!OpenDocument

[16] CONGRESSIONAL RESEARCH SERVICE, *EPA's Proposed Greenhouse Gas Regulations: Implications for the Electric Power Sector*. June 23, 2014. Available at: http://www.crs.gov/pdfloader/R43621.

[17] U.S. ENVIRONMENTAL PROTECTION AGENCY, *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, Proposed Rule, 79 FR 34832, June 2, 2014.

1. Installing technologies to increase efficiency at power plants.
2. Giving Natural Gas Combined-Cycle plants priority over steam-boilers.
3. Building new renewable power generation.
4. End-user efficiency technologies and programs that reduce power demand.

EPA proposes that these building blocks represent the "best system of emissions reduction" that has been adequately demonstrated for fossil-fuel power plants regulated under the EPA rule.

According to EPA, the proposed rule will be "implemented through a state-federal partnership under which states identify a path forward using either current or new electricity production and pollution control policies to meet the goals of the proposed program. The proposal provides guidelines for states to develop plans to meet state-specific goals to reduce carbon pollution and gives them the flexibility to design a program that makes the most sense for their unique situation."[18]

Modified Power Plants

On the same day as the 111(d) "Clean Power Plan," EPA also unveiled a separate 111(b) "Modified Source Proposal," in which EPA explained:

> *For more than four decades, the EPA has used its authority under CAA section 111 to set cost-effective emission standards that ensure newly constructed, reconstructed and modified stationary sources use the best performing technologies to limit emissions of harmful air pollutants. In this proposal, the EPA is following the same well-established interpretation and application of the law under CAA section 111 to address GHG emissions from modified and reconstructed fossil fuel-fired electric steam generating units and natural gas-fires stationary combustion turbines.*[19]

The proposed rule for Modified Sources only applies to fossil-fueled power plants that undergo major modifications or reconstruction. In contrast with the broad approach EPA utilized for existing power plants, this proposal identifies a "combination of best operating practices and equipment upgrades" as the "best system of emission reduction" and arrives at a unit specific standard requiring 2% efficiency gains.

ADDITIONAL READING

CONGRESSIONAL RESEARCH SERVICE. *Climate Change and Existing Law: A Survey of Legal Issues Past, Present, and Future.* March 10, 2014. *Available at* http://www.crs.gov/pdfloader/R42613.

[18] http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/5bb6d20668b9a18485257ceb00490c98!OpenDocument .

[19] U.S. ENVIRONMENTAL PROTECTION AGENCY. "Carbon Pollution Standards for Modified and Reconstructed Stationary Sources: Electric Utility Generating Units; Proposed Rule." June 2014. *Available at* http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13725.pdf.

CONGRESSIONAL RESEARCH SERVICE. *EPA's Proposed Greenhouse Gas Regulations: Implications for the Electric Power Sector*. June 23, 2014. *Available at* http://www.crs.gov/pdfloader/R43621.

CONGRESSIONAL RESEARCH SERVICE. *EPA's Proposed Greenhouse Gas Regulations for Existing Power Plants: Frequently Asked Questions*. July 3, 2014. *Available at* http://www.crs.gov/pdfloader/R43572 .

U.S. ENVIRONMENTAL PROTECTION AGENCY. *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, Proposed Rule. 79 FR 34832. June 2014. *Available at* http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule.

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COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
CHAIRMAN LAMAR SMITH

For Immediate Release
July 30, 2014

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Statement of Energy Subcommittee Chairman Cynthia Lummis (R-Wyo.)
Hearing on EPA's Carbon Plan: Failure by Design

Chairman Lummis: Today, we examine one of the most sweeping regulatory proposals in America's history. The Environmental Protection Agency (EPA) is continuing its regulation rampage, attempting to take control of our nation's electric system without any legal or scientific justification.

The EPA's "Clean Power Plan" reaches well beyond just the regulation of power plants. The EPA wants to control the entire system, right down to the amount of electricity Americans use in their homes.

The implications of this overreach are staggering. The rule has the potential to shut down power plants across the nation, raise energy prices and threaten energy security. And for what? Even EPA admits that the rule will have little to no impact on global warming.

EPA's proposal would impose standards on states that turn their power systems on their heads. Each state's reduction mandate varies widely, based on what EPA claims can be done through a combination of costly efficiency technologies, drastic fuel switching, and unprecedented reliance on intermittent renewables and energy rationing.

States, companies, utility commissioners and local officials are left figuring out how to comply, which will necessarily involve higher prices and potentially threaten grid reliability. The EPA claims the rule is flexible, and that compliance is easy. But EPA's assurances are of little comfort when the standards are beyond what technology can deliver.

The ability of the EPA's "building blocks," which might as well be called mandates, to produce the required reductions is uncertain at best. The limited analysis in this rule is based on black box models and untested assumptions. This hides the hard fact that states will be left holding the bag on an expensive overhaul of our electric system to reach theoretical and unproven targets.

The confusion also hides a more fundamental concern: the EPA is operating outside the bounds of the law. The Clean Air Act does not give the EPA the authority to regulate the electric grid or tell Americans where to set their thermostat. Instead, EPA is limited to technology-based standards at the power plants themselves.

As our witnesses will explain, had EPA followed the law and been honest about what technology can accomplish, the rule might be manageable. But since the law doesn't match the President's partisan agenda, the EPA is now bypassing Congress to rewrite the statute. This comes as no surprise from this Administration.

The EPA also ignores technology and reliability concerns. The Administration hasn't fully considered the potential impacts of this proposal on the electric system, the economy and the American people.

A scientific look at the proposal reveals major problems. EPA's claims are backed by flawed technology assumptions. It relies on unrealistic scenarios about our nation's energy future. And EPA's conclusions are based on a secret model, hidden from public view.

Instead of providing useful tools for state and local policymakers, the analysis appears to be nothing more than window-dressing for a predetermined outcome.

We see this all too often at the EPA. It undermines the scientific review process and moves straight to regulation. The law requires a bottom-up review of what can be accomplished at a power plant. Instead, the EPA has proposed top-down regulation of the entire electric system.

This rule needs to be withdrawn. It fails to meet even the most basic standards of objectivity and transparency; and it lacks technical analysis on scientific and economic feasibility. The American people deserve to know exactly what the EPA is doing, and that is why we are having this hearing today.

OPENING STATEMENT

Ranking Member Eddie Bernice Johnson (D-TX)
Committee on Science, Space, and Technology

Full Committee Hearing
"EPA's Carbon Plan: Failure by Design"

July 30, 2014

Thank you, Mr. Chairman, and thank you to our witnesses for being here this morning. Last month, the Environmental Protection Agency released its Clean Power Plan, a proposal to cut carbon pollution from the largest source – power plants.

This proposal like the rest of President Obama's Climate Action Plan, is the bold step forward our nation needs to address the impacts of climate change. Impacts that are growing more present in the lives of every American. Severe drought, record temperatures, and an increase in the spread of infectious disease are just a few examples of what Americans will have to confront in the coming years.

The scientific evidence confirms that we need to act now to lessen these impacts. Cutting carbon emissions from the power sector is critical to any solution and that is why I support the Clean Power Plan. It sets reasonable limits that take into account the characteristics of each state. It is based on strategies already in use such as improving energy efficiency and power plant operations, and encouraging the development of renewables. And finally, it provides the states with flexibility; EPA is not prescribing a specific set of measures. States will choose what goes into their plans and they can work alone or as part of a multi-state effort to achieve meaningful reductions.

Today we will hear from some Members and witnesses that EPA is acting beyond its authority, and that EPA regulations are killing the economy and jobs.

This is not a new argument, but one that we have heard time and time again. Whenever, EPA proposes an action that will protect the air we breathe or the water we drink, industry raises alarms about the purported negative impact on the economy. I expect we will hear the same argument trotted out again at today's hearing.

In addition, some of my colleagues on the other side of the aisle are fond of saying that those who want to address climate change are alarmists, using "scare tactics" to frighten the American people. I would say that the true alarmists are those who have a history of exaggerating the cost of compliance. For example, in 1990, electric utilities opposed to the acid rain program said the

cost of an allowance to emit sulfur dioxide would be $1,500 per ton. It, in fact, turned out to be $150 per ton.

Mr. Chairman, I could go on, but the track record of the Clean Air Act speaks for itself. Since its adoption in 1970, air pollution has declined by more than 70 percent and the American economy has more than tripled. Now, more than ever, the American people need a strong EPA. I firmly believe we can have a vibrant economy and a safe and healthy environment. The Clean Power Plan puts us on the path to achieving both.

Thank you and I yield back.

Testimony of Jeffrey R. Holmstead
before the
U.S. House Committee on
Science, Space, and Technology
July 30, 2014

Thank you Chairman Smith, Ranking Member Johnson, and distinguished members of the Committee for inviting me to participate in today's hearing.

My name is Jeff Holmstead. I am a partner in the law firm of Bracewell & Giuliani and have been the head of the firm's Environmental Strategies Group (ESG) since 2006. For almost 25 years, my professional career has been focused on policy, regulatory, and legal issues arising under the Clean Air Act. From 1989 to 1993, I served in the White House Counsel's Office as Associate Counsel to President George H.W Bush. In that capacity I was involved in many of the discussions and debates that led to the passage of the 1990 Amendments to Clean Air Act – and was then deeply involved in the initial efforts to implement those Amendments. From 2001 to 2005, I was the Assistant Administrator of EPA for Air and Radiation and headed the EPA Office in charge of implementing the Clean Air Act. I am well acquainted with the legal, policy, and practical issues associated with the Clean Air Act and efforts to regulate carbon and other greenhouse gases under the Act.

I am pleased to come before you today to discuss the EPA's proposal to regulate carbon dioxide emissions from existing power plants. There is much to say about this proposal, but I will focus on 2 main concerns: (1) EPA's proposal goes well beyond its legal authority under the Clean Air Act by trying to force states to regulate anything that produces or uses electricity; and (2) EPA has been so distracted by the notion that it can fundamentally change the electricity system in all 50 states that it has not done the technical work needed to develop legally sound regulations to reduce carbon emissions from existing fossil fuel power plants.

At the outset, I want to note an important issue that I will not address in any detail. EPA proposes to regulate existing power plants under Section 111(d) of the Clean Air Act. Given that it has already regulated power plants under Section 112, there are significant legal questions as to whether EPA has authority to regulate power plants at all under Section 111(d). Attorneys General in many states, along with many other parties, have already raised this issue, and the courts may well decide that EPA is precluded from issuing any type of power plant regulation under Section 111(d). In today's testimony, however, I will assume that EPA does have authority to use 111(d) to regulate carbon emissions from power plants and will focus only on the type of regulation that is legally permissible under Section 111(d).

EPA's Authority to Regulate GHGs under the Clean Air Act

The Supreme Court has made it clear that EPA has authority to regulate carbon dioxide (CO2) and other greenhouse gases (GHGs) under the Clean Air Act (CAA). But the Supreme Court has not given EPA a roving mandate to do whatever it thinks best when it comes to regulating greenhouse gases. In the CAA, Congress created a number of different regulatory programs with

carefully defined limits. Some of these programs can be used to regulate greenhouse gases, but EPA may only do so in a way that complies with the limits established by Congress.

A recent Supreme Court decision makes this point quite clearly. On June 23rd, the Court issued its decision in *Utility Air Regulatory Group v. Environmental Protection Agency (UARG v. EPA)*. In that case, the Court overruled EPA's determination that emissions of CO2 and other GHGs trigger certain CAA permitting requirements. Although the Court did allow EPA to require GHG permit limits for projects that must have permits for conventional pollutants, it reminded EPA that the Agency does not have unfettered authority to regulate carbon emissions in any way the Agency might want. Instead, the Court ruled that EPA must craft regulations that are consistent with the statutory language of the CAA.

Section 111 of the Clean Air Act

Section 111, in essentially its current form, has been in place since 1977, and anyone who works on CAA issues is familiar with it. Before issuing any type of regulation under Section 111, EPA must first identify specific types of facilities (which are generally known as "sources" under the CAA) that, in EPA's judgment, emit air pollution that endangers public health. As part of this process, EPA creates "source categories" and carefully defines the type of facilities that fall within these categories.

For power plants (and other types of sources as well), EPA has also created "subcategories" to reflect the fact that there are different types of power plants – traditional coal-fired plants, plants known as IGCC plants that burn gasified coal, combined-cycle natural gas plants, and simple-cycle natural gas plants. Sometimes there are different subcategories for different sizes of the same type of plant. These subcategories are important because the best system for controlling emissions can be quite different for different types of plants. More importantly, the emission rate that can be achieved with these systems can vary greatly for different types of plants. For ease of explanation, I will use "category" to refer to both categories and subcategories.

Once EPA has defined a category, it then develops, under Section 111(b), a "standard of performance" for a particular pollutant. Once such a standard is issued, any new facility that falls within the defined category must comply with it. These standards are often called "new source performance standards" or NSPS. The CAA air includes two different but complementary definitions of the term "standard of performance," and any EPA regulation must comply with both of them.

> Section 111(a): The term "standard of performance" means a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.
>
> Section 302(l): "The term "standard of performance" means a requirement of continuous emission reduction, including any requirement relating to the operation or maintenance of a source to assure continuous emission reduction."

As a shorthand, CAA practitioners often refer to the first definition as BSER, because a standard of performance must reflect the application of the "best system of emission reduction" (BSER) to sources that fall within the category being regulated.

Under Section 111(b), EPA has set dozens of different "standards of performance" by identifying the BSER that can be applied to the types of facilities included in the regulated category. As noted above, these standards are generally set as an emission rate that can be achieved by the use of BSER, and any new facility in the category must meet them. EPA has recently used Section 111(b) to propose standards of performance for CO2 emissions from different types of new fossil fuel power plants. As proposed, these standards would establish an allowable emission rate in terms of CO2 emissions per MMBtu – in essence, an allowable amount of CO2 per unit of electricity produced. If these standards are finalized and upheld in court, then any new coal- or gas-fired power plant must meet the standard of performance that applies to that particular type of plant.

Section 111(d) comes into play only after EPA has set a standard of performance for new plants in a source category under Section 111(b) – and only for pollutants that are not regulated as either "criteria pollutants" or "hazardous air pollutants" under other parts of the CAA. (As noted above, EPA may be precluded from using Section 111(d) for any source category that is regulated under Section 112, but I am assuming that this is not the case for now.) Because virtually all pollutants are regulated as either criteria or hazardous air pollutants, Section 111(d) has only been used five times before, but the key term in section 111(d) is the same as the key term in Section 111(b) -- and is a term that EPA has interpreted consistently (with one exception in a regulation that was vacated in court) for almost 40 years. Here is what it says:

> The Administrator [of EPA] shall prescribe regulations which shall establish a procedure . . . under which each state shall submit to the Administrator a plan which establishes standards of performance *for any existing source . . . to which a section 111(b) standard of performance would apply if such existing source were a new source.*

The statutory scheme is quite straightforward. Under Section 111(b), EPA is required to establish "standards of performance" for any new source within a listed category; and then, under Section 111(d), each state is required to submit a plan that establishes "standards of performance" for "any existing source" in the same category. In either case, it is quite clear from the statute that this standard applies to an individual source – to any new source in the country or to "any existing source" in the state.

This is also clear from another part of Section 111(d), which says that EPA's 111(d) regulations

> shall permit the State in applying a standard of performance *to any particular source* under a plan submitted under this paragraph to take into consideration, among other factors, the remaining useful life of *the existing source* to which such standard applies.

Thus, the statute certainly contemplates that a standard of performance is something that each and every regulated source must meet. EPA agrees with this reading when it comes to new

sources. Over the years, the Agency has established dozens of different "standards of performance" for new sources, and all of them apply to any new source within the regulated category or subcategory. This is even true for carbon emissions. EPA recently proposed "standards of performance" to regulate carbon emissions from new fossil fuel power plants based on its view of the best system of emission reduction that can be applied to each type of plant. If these standards are finalized and upheld in court, each new plant must meet the applicable standard of performance.

But for existing sources, EPA now claims that a "standard of performance" can actually be much broader. Rather than requiring states to submit plans that establish standards for individual power plants, EPA is proposing to require states to submit plans to regulate the whole "electricity system" in the state – and anything connected to that system by either producing or using electricity. Rather than set an emission rate for each existing plant, each state must meet a statewide CO2 emission rate based on a rather complex formula that includes most, but not all, the power generating sources in the state and an estimate of the CO2 emissions avoided by energy efficiency programs designed to reduce electricity demand in the state. This legally binding CO2 emission rate varies substantially from state to state depending on EPA's view of how each state should change its current electricity system.

This whole program is based on a 37-year old provision in the CAA which says that, under certain circumstances, EPA may requires states to submit "a plan which establishes standards of performance for any existing source . . . to which a section 111(b) standard of performance would apply if such existing source were a new source." To support its expansive new reading of this provision, EPA points to one part of the statutory definition of the term "standard of performance," which says:

> The term "standard of performance" means a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of *the best system of emission reduction* which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.

EPA focuses on the word "system" and argues that a "system" can involve many different things that all fit together, like the electricity system in a state. But the statute does not say that EPA can regulate a "system." It says that EPA and the states are to set standards for emissions of air pollutants based on the "application of the best system of emissions reduction." The question is not what a "system" may be. Rather, the question is the best system as "applied to what"? EPA says, "as applied to anything that produces or uses electricity in the state." But the answer, according to the statute and almost 40 years of regulatory history, is "as applied to the individual sources within the source category being regulated." In the context of Section 111(d), this means to "*any existing source*," as long as, "in applying a standard of performance *to any particular source,*" the state is able to "take into consideration, among other factors, the remaining useful life of *the existing source* to which such standard applies.

The other part of the CAA definition of the term "standard of performance," in Section 302(l), also makes this clear:

> The term "standard of performance" means a requirement of continuous emission reduction, including any requirement relating to the operation or maintenance *of a source* to assure continuous emission reduction.

The only plausible reading of the statute is that a standard of performance must be based on "the best system of emission reduction" that can achieve a "continuous emission reduction" at "a source" being regulated, whether it is a new source or an existing source. However, although the term "standard of performance" is the same for both new and existing sources, EPA now claims that, when it comes to existing power plants (but not new ones), the term empowers it to require all fifty states to change the way that electricity is produced and used within their borders. If so, this would be a breathtaking expansion in EPA's authority based on a novel reading of a statutory provision that has existed for almost 40 years. This is why a number of Supreme Court observers believe that, in its recent *UARG* decision (which was released just weeks after EPA announced its proposal to regulate existing power plants), the Court may have been sending a message to EPA:

> When an agency claims to discover in a long-extant statute an unheralded power to regulate 'a significant portion of the American economy,' Brown & Williamson, 529 U. S., at 159, we typically greet its announcement with a measure of skepticism. We expect Congress to speak clearly if it wishes to assign to an agency decisions of vast 'economic and political significance.'"

<u>What EPA Can Do To Reduce CO2 Emissions But Has Failed to Do</u>

In its 111(d) proposal, EPA has identified four "building blocks" that it uses to develop a CO2 emission rate that applies to the electricity system (at least most of it) in each state. According to EPA, these building blocks make up the "best system of emission reduction" for the state as a whole. The first one – and the only one that has anything to do with EPA's statutory authority under Section 111 – is based on improvements in efficiency that existing coal-fired power plants can achieve by making changes to their equipment or operations. Where such improvements are possible, they would reduce the carbon emissions rate of individual power plants, as envisioned under Section 111.

But rather than actually doing the technical work necessary to establish legally defensible efficiency standards for existing power plants, EPA simply asserts, with essentially no technical basis, that existing coal-fired power plants can boost their efficiency by 6 percent on average – meaning that they can produce a given amount of electricity by burning 6 percent less coal. Each state is then required to reduce carbon emissions by the amount that would be achieved if every coal-fired plant in the state improved its energy efficiency by 6 percent. It doesn't matter if power plants in one state already are more efficient than those in another. All states are required to reduce CO2 emissions based on the assumption that their existing plant can produce the same amount of electricity with 6 percent less fuel.

Before EPA can set legally defensible efficiency standards for existing plants, it needs to conduct a more rigorous process backed by research and data. First, the Agency must determine the heat rate (a measure of efficiency) that can be achieved by different types of existing plants. Then it

can establish a carbon emissions rate – as it has already proposed for new plants – rather than an arbitrary percent reduction. When doing so, EPA officials will also need to recognize that existing plants differ significantly from one another, so they will almost certainly need to establish subcategories for different plants based on size, boiler type, age, and other factors. Only then can they establish a carbon emissions rate for each subcategory based on what can be achieved by sources in that subcategory.

Based on discussions with industry experts – people whose job is to make power plants as efficient as possible – it appears that an efficiency improvement of 6 percent is unrealistic for most plants. The Agency must base any requirements on credible research and actual data. To date, EPA has been so distracted by the notion that it can fundamentally change the electricity system in all 50 states that it has not done the technical work needed to develop legally sound regulations to reduce carbon emissions from existing fossil fuel power plants.

A Wasted Opportunity

Over the next year, many different groups – environmental advocacy organizations, companies and trade associations, and state and local governments – will be forced to spend an enormous amount of time and effort trying to understand and comment on a very complicated proposal that is almost certainly unlawful. Even if companies and state and local officials and utility commissioners believe, as I do, that the proposal will never be implemented, they cannot simply ignore it. They must perform studies and hold meetings and try to figure out what they would be required to do on the chance that it will actually come into place. Then, assuming the EPA ignores the legal and practical concerns that have been raised and issues a final rule that follows the same general approach, all these parties will be spending much more time and effort trying to come up with state plans to meet requirements that will almost certainly be set aside.

EPA's very capable staff will also be focused on remaking the electricity system in all 50 states – something it is not authorized or well equipped to do. Rather than devoting so much time and effort on things that are outside its purview, EPA should do what it is supposed to do under the CAA. It should do the technical work that will be needed to reduce carbon emissions from existing power plants by establishing legally defensible standards of performance that will reduce the carbon emission rate from individual power plants.

* * * * *

Again, I very much appreciate the opportunity to appear before the Committee and hope that my testimony will be helpful to you as you review the many issues raised by EPA's proposal to regulate the production and consumption of electricity in the U.S.

Jeffrey R. Holmstead

Jeff Holmstead, former Assistant Administrator of the United States Environmental Protection Agency (EPA) for Air and Radiation, is one of the nation's leading air-quality lawyers and heads the Environmental Strategies Group (ESG) at Bracewell & Giuliani. The ESG is a multi-disciplinary group that includes environmental and energy attorneys, public policy advocates, and strategic communications experts – most of whom have had high-level government experience. Under Mr. Holmstead's leadership, they work together on daily basis to advise and defend companies and business groups confronting major environmental and energy-development challenges, both domestically and globally.

From his time in both the government and the private sector, Mr. Holmstead is very familiar with the environmental and energy challenges facing the business community. He advises clients dealing with an increasingly complex regulatory, legal and public relations landscape, drawing on his experience in policy development, administrative and legislative advocacy, litigation and strategic communications. He has worked with clients in a number of industries on issues related to climate change, Clean Air Act policy and enforcement, and energy policy — including the development of new coal-fired power plants, refineries, renewable energy sources, and electric transmission infrastructure.

Mr. Holmstead headed the EPA's Office of Air and Radiation from 2001 – 2005, longer than anyone in EPA history. During his tenure, he was the architect of several of the agency's most important initiatives, including the Clean Air Interstate Rule, the Clean Air Diesel Rule, the Mercury Rule for power plants and the reform of the New Source Review program. He also oversaw the development of the Bush Administration's Clear Skies Legislation and key parts of its Global Climate Change Initiative. Prior to his appointment at EPA, Mr. Holmstead was a partner in the Environmental Group of Latham & Watkins, which he joined in 1993. Between 1989 and 1993, Mr. Holmstead served on the White House Staff as Associate Counsel to former President George H.W. Bush. In that capacity, he was involved in the passage of the Clean Air Act Amendments of 1990 and the key steps taken to implement those amendments. From 1987 to 1988, he served as a law clerk to Judge Douglas H. Ginsburg on the U.S. Court of Appeals for the District of Columbia.

Education
J.D., Yale Law School, 1987
B.A., *summa cum laude*, Brigham Young University, 1984

Bar Admissions
District of Columbia

Noteworthy
Chambers USA: America's Leading Lawyers for Business, Climate Change, 2010-2013; Environment, 2008-2013
US Legal 500, Environment: Litigation, 2012
Best Lawyers in America, Environmental Law, 2008-2010 and 2013

EPA'S CARBON PLAN: FAILURE BY DESIGN

Testimony before the Committee on Science, Space, and Technology

United States House of Representatives

July 30, 2014

The Honorable Charles D. McConnell

Executive Director, Energy and Environment Initiative, Rice University

Former Assistant Secretary for Fossil, U.S. Department of Energy

Introduction

We all want clean air to breathe and clean water to drink, and there is a growing consensus on the need to reduce our greenhouse gas (GHG) emissions, especially CO_2 emissions. However, how we approach achieving GHG reductions is critical to being able to do so and protect our economy, our global competitiveness and the very quality of our lives. The EPA's proposed rulemaking does not meet the test of relevant and impactful policy to reduce such emissions.

Whenever emission reductions are judged to be needed, some immediately turn to more regulation as a solution without honestly and objectively considering whether the necessary technology is available to achieve that regulation. If the technology is not available, passing a regulation that requires its deployment makes no sense. It can take well over twenty years to develop a technology from its laboratory cradle through commercial demonstration and many more years to achieve broad commercial deployment. Technology enables innovation and regulation and not vice versa. Once a given technology is commercially viable and available, correctly written regulation can incentivize further, incremental improvement of that technology.

So where are we today with commercially viable CO_2 capture and storage or utilization (CCS/CCUS) technology? Commercial CCS technology is still in the laboratory cradle. Today's CCS technology deployed on a coal power plant will increase the cost of the generated electricity by 80 percent (the size of the cost penalty varying with the percentage capture), with unknown overall plant reliability and availability and unknown long-term CO_2 storage liability. Worse yet, DOE has been dramatically cutting the budget for developing CCS technology, thus assuring that its commercial availability will be delayed by decades. Even the Senate Appropriations Committee in its Energy and Water Subcommittee markup for the fiscal year 2015

appropriations bill last week, cut funding for CCS and power systems by over 30 percent (from the current $392M level to $267M).

What does all of this mean? These facts are well known to EPA officials, leading an objective observer to conclude that the EPA motivation for issuing its GHG regulations was not to reduce GHG emissions, but rather to eliminate fossil fuels – first by eliminating coal use and later natural gas and other fuels – irrespective of its economic impacts on consumers (especially low income consumers). EPA will manipulate numbers and disagree that their regulations are causing severe economic impacts, but the fact is that electricity prices are rising in states that are retiring coal plants. DOE will cite the billions of dollars spent on current CCS demonstration projects (over 80 percent of those funds are from the private sector). These demonstrations are needed to demonstrate the operability of current CCS/CCUS technology. However, they are not currently operating and they will not be demonstrating the low cost CCS technology that has yet to be developed and that is necessary to meet EPA GHG regulations. EPA has essentially recognized this point by not requiring CCS on existing coal plants and imposing requirements that will result in the replacement of existing coal plants thus making their motives and strategy transparent to all.

Existing Fleet and Efficiency

EPA has proposed four "building blocks" to get to the goal of reducing carbon emissions from coal-fired power plants by 30 percent from 2005 levels by 2030. Those are: improve efficiency at each power plant by 6 percent as a fleet-wide average; employ "environmental dispatch" to run natural gas plants more and coal plants less; substitute renewable energy for coal; and reduce demand from consumers by 1.5 percent per year.

So let's talk about power plant efficiency. What does a 6 percent efficiency improvement look like? To be honest, I can't tell you, and I'm not sure anyone can really tell you, because I'm not sure it's ever been done before. The existing coal fleet average efficiency is somewhere in the 33 to 35 percent range, meaning a power plant is 33 to 35 percent efficient in converting the energy value of the raw material into actual usable energy output, or Btus. If you converted a power plant from 35 percent efficiency to 41 percent efficiency, you essentially would be looking at rebuilding the entire plant. AEP's Turk plant in Arkansas will have a 39-40 percent steam cycle efficiency, as opposed to about a 35 percent average coal-fired plant steam cycle efficiency. To get those extra 4-5 percent efficiency points, they built a plant that is entirely different from a subcritical coal plant.

The National Coal Council's (NCC) most recent report, issued just two months ago, specifically looked at possible power plant efficiency improvements. The NCC stated that its report "does not provide a quantitative assessment of the degree to which these existing technologies could improve the heat rate (or efficiency) of the existing coal fleet," but there are other credible sources to show what is feasible for existing coal plants.[1] For example, an International Energy Agency paper from the fall of 2013 noted that "Retrofits will increase efficiency significantly, by up to as much as 2–3 percentage points, and may compensate completely for loss of performance from addition of environmental control equipment after a plant was first commissioned."[2] Two to three percent. That's half to one-third of EPA's six percent.

[1] See the Reliable & Resilient: The Value of Our Existing Coal Fleet the National Coal Council's May 2013 report at http://www.nationalcoalcouncil.org/NEWS/NCCValueExistingCoalFleet.pdf

[2] International Energy Agency, Upgrading and efficiency improvement in coal-fired power plants, No. 13/9, August 2013, http://www.iea-coal.org.uk/documents/83185/8784/Upgrading-and-efficiency-improvement-in-coal-fired-power-plants,-CCC/221.

The NCC's report does list a number of changes that could be made at a power plant to improve efficiency. It is useful to simply insert here the findings of that expert group on power plant efficiency improvements, as summarized in the report's executive summary:

> "[C]oal could potentially be dried using waste heat, making the boiler more efficient. Steam turbines could potentially be refit with modern and more efficient multistage rotors. In addition, corrosion and deposition on major heat transfer components (boiler tubes and condensers) could potentially be reduced, making heat transfer in those components more efficient.
>
> "On some units, alkali materials can be injected into flue gases to reduce acidity that would otherwise present corrosion problems at low temperatures, thereby potentially allowing greater heat recovery from flue gases. Improved sensors and controls could potentially allow a plant to operate closer to conditions optimal for higher efficiency. Variable speed drives could potentially be used to make motors more efficient, particularly at lower load.
>
> "While many of the needed technologies already exist and are operating on some units, these are not a one-size-fits-all package of solutions that can be readily applied to or accommodated by the existing coal fleet. The opportunity to apply these efficiency improvements across the existing fleet will vary significantly.
>
> "In some cases, the opportunity will be negligible because the unit either is already operating in a highly efficient mode with some or all of the improvements in place or because the implementation of potential improvements is not cost-effective and/or technically feasible. As such, the degree of efficiency improvement possible at a given unit is highly site-specific, and may depend on the design of the unit, current maintenance

procedures, whether the unit operates as base load or cycling, the type of coal used by the unit, system economics and the economics of the specific measure and the configuration of the unit. Even the location of a unit is relevant to efficiency because plant efficiency is sensitive to ambient temperature and atmospheric pressure (elevation)."[3]

Congress recognized in the Energy Policy Act of 2005 that getting even 4 percent efficiency improvement was so costly that it established a massive tax credit as an incentive. Section 1307 of the EPACT provides $1.3 billion in tax credits to "advanced coal-based generation technology" projects, which for existing units are defined to include projects on units that "achieve[] a minimum efficiency of 35 percent and an overall thermal design efficiency improvement, compared to the efficiency of the unit as operated, of not less than –

- 7 percentage points for coal of more than 9,000 Btu
- 6 percentage points for coal of 7,000 to 9,000 Btu, or
- 4 percentage points for coal of less than 7,000 Btu"[4]

By the way, that's a "design" efficiency improvement, which recognizes that the plant ultimately may get less thermal efficiency improvement in operation.

The bottom line is that Congress knew this was "rebuild the power plant" levels of efficiency improvements, hence the tax credit. EPA, of course, argues that the proposed rule provides "flexibility," and that not everyone will have to do this everywhere. Yet its final GHG reduction level is based on 6 percent efficiency improvement being the industry-wide average (i.e., because it has baked 6 percent industry-wide efficiency improvement into the 30 percent below 2005 level target).

[3] See the pg. 4-5 of Reliable & Resilient: The Value of Our Existing Coal Fleet the National Coal Council's May 2013 report at http://www.nationalcoalcouncil.org/NEWS/NCCValueExistingCoalFleet.pdf
[4] See P.L. 109-58 Section 1307 at http://www.gpo.gov/fdsys/pkg/PLAW-109publ58/html/PLAW-109publ58.htm

Finally, it is important to note that there are legal barriers to doing power plant efficiency improvements, and EPA knows it well. Specifically, significant changes to an existing power plant trigger a provision of the Clean Air Act known as "New Source Review" or NSR. Essentially, under this statutory provision, existing industrial facilities are treated like new facilities for the purposes of clean air permitting when "major modifications" are made, meaning they become subject to more stringent air limits that can be very expensive to meet. EPA had discretion in determining what is a major modification, and power plants and other industrial facilities sensibly do all they can to avoid triggering the requirements and their subsequent expenses. In the case of CO2 emissions, EPA surely must know it is creating a catch-22: big efficiency improvements will trigger NSR, which will require the installation of equipment to reduce other emissions and decrease efficiency. Again, the NCC's report summarizes the issue well: "In general, if a plant owner expects that an efficiency improvement would lead to [NSR] designation, the efficiency project will not be pursued as the resulting permitting process would be extensive and the compliance requirements would be onerous and likely too stringent to be practicable. Unfortunately, this prospect has all but eliminated RD&D that would more than marginally innovate the fleet."[5]

Current Situation (Failure by Design)

On June 25, 2013, President Obama issued his Presidential Memorandum – Power Sector Carbon Pollution Standards. In this memorandum to EPA, he directed the agency, by September 30, 2013, to issue a new proposed rule to establish New Source Performance Standards (NSPS) for CO_2 emissions from fossil fueled power plants, replacing the rule EPA proposed for that

[5] See the pg. 5 of Reliable & Resilient: The Value of Our Existing Coal Fleet the National Coal Council's May 2013 report at http://www.nationalcoalcouncil.org/NEWS/NCCValueExistingCoalFleet.pdf

sector on April 13, 2012. He also directed EPA to propose standards or guidelines governing emissions from existing power plants by June 1, 2014.

The most constructive thing that can be said about the resulting proposed regulations is that EPA almost met the President's schedule. They published the first rule on their website on September 20, although it did not appear in its final form in the Federal Register until January 8, 2014. The existing source rule was released on EPA's website on June 2, and the formal version was printed in the Federal Register on June 18. That's the good news.

The bad news is that these proposals follow such a tortured logic that there is a reasonable likelihood that a reviewing court will, perhaps three of four years from now, determine that EPA's legal and technical arguments lack merit and the agency must start over again.

My background is in technology and I would like to offer you my views on why I believe that EPA's two proposed power plant rules are harmful to technology development, and, because of that, will probably have the perverse effect of increasing CO_2 emissions, regardless of whether they withstand litigation or are reversed.

First, let us review the fundamental legal criterion for both the Section 111(b) NSPS rule and the Section 111(d) existing source performance standards rule: the Clean Air Act's definition of a "standard of performance." "The term 'standard of performance' means a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." The key phrase here is "best system of emission reduction which … has been

adequately demonstrated." These are the brutal facts regarding the technology we are all focused upon, CCS:

- The technology is not "adequately demonstrated." In fact, it has not been demonstrated at all in the sense Congress intended in the Clean Air Act. There is no commercial scale CCS system operating on a power plant (coal, gas, or oil-fired) anywhere on the planet. That is a fact.
- At least two major power plant vendors have provided official statements that CCS technology is not ready for commercial deployment. The first, Bob Hilton, VP at Alstom Power, offered his view before this Committee at a hearing on March 12, 2014. "Alstom does not currently deem its technologies for Carbon Capture commercial and, to my knowledge, there are no other technology suppliers globally that can meet this criteria or are willing to make a normal commercial contract for CCS at commercial scale." [6] The second view was offered by B&W in that company's formal comments on EPA's proposed NSPS rule. "As a developer and supplier of C02 capture technologies, we do not agree that these technologies are ready for commercial deployment on new EGUs today to meet this emission limit." [7] These statements from two companies at the forefront of CCS and power technology are tantamount to facts.
- Multiple reports and technical studies by the Department of Energy have concluded that adding CCS to a traditional coal-fired power plant will increase the cost of electricity from that unit by about 80 percent. This is an unacceptable cost increase and is one of the primary reasons that DOE spends about $400 million a year to improve CCS technology. These are facts.

[1] Testimony by Robert Hilton before the US House of Representatives Subcommittee on Environment and Subcommittee on Energy, of the Committee on Science, Space, and Technology, March 12, 2014.
[7] B&W, Comment available on the EPA regulatory docket, document # EPA-HQ-OAR-2013-0495-8348.

- Although we are conducting research in carbon storage, we have relatively little experience with injection of large quantities of CO_2 into geologic formations – none at the 3-4 million TPY rate typical for a large coal-fueled power plant. EPA regulations intended to protect groundwater supplies require CO_2 storage facilities to monitor the underground CO_2 plume for 50 years after CO_2 injection has ceased to ensure that nothing goes wrong. These are facts.
- The other option for storage of CO_2 is Enhanced Oil Recovery (EOR), which provides the economic bonus of enabling production of high value crude oil. However, EPA's proposed NSPS included provisions making EOR activities impractical, at least in the view of one major EOR producer. A white paper[8] on the reporting requirements of the rule by Denbury stated, "the proposed NSPS rule will ***foreclose – not encourage*** – the use of CO_2 captured by emission sources in EOR operations." [emphasis in original] EPA's requirements convert a resource recovery operation into a waste disposal operation, which is incompatible with EOR activities. EOR is a dynamic process that involves "a host of changes to the originally-approved plan." EPA's proposed monitoring, reporting, and verification requirements would necessitate re-permitting the operation after every change and expose the project to time consuming permit challenges and litigation. More unpleasant facts.

Against these facts, let us review EPA's views on CCS technology:

[8] Subpart RR Flaws Preclude EPA's Reliance on CO2-EOR in the Proposed NSPS Rule, Denbury, (undated).

- "[W]e are not proposing that CCS does or does not qualify as the ''best system of emission reduction'' that ''has been adequately demonstrated'' for new coal-fired power plants."[9]
- "EPA believes that partial CCS should be considered BSER."[10]
- "The EPA believes the cost of 'full capture' CCS without EOR is outside the range of costs that companies are considering for comparable generation and therefore should not be considered BSER …."[11]
- "[T]he EPA is not proposing and does not expect to finalize CCS as a component of the BSER for existing EGUs in this rulemaking."[12]

These are EPA's views from regulatory proposals for new and existing power plants made public in 2012, 2013 and 2014, seemingly (and in some cases actually) conflicting with one another, without any significant change in during that period in the readiness of the technology.

I believe in technology solutions to technical problems like pollution. There is a strong track record of government and the private sector collaborating to develop technologies like flue gas desulfurization, selective catalytic reduction, and mercury capture systems – when provided adequate federal resources and time. Past NSPS rules for SO2 and NOx emissions did this: they based a regulation on proven, monitored application of a technology on many commercial scale units. I believe that with adequate time and resources, CCS can make a major contribution to the effort to address global climate change. However, the Administration in its proposed CO_2 NSPS

[9] USEPA, preamble to 2012 proposed power plant NSPS. 77FR22411, April 13, 2012.
[10] USEPA, preamble to 2014 proposed power plant NSPS. 78FR1479.
[11] Ibid., p.1435.
[12] USEPA, preamble to 2014 proposed rule for existing power plants, 79FR34857, June 18, 2014.

can point to no commercial operating units with CCS, and the Administration is proposing again to reduce funding for coal and CCS research.

This is not just about coal, or CCS, or electric utilities. The existing coal fleet provides about 40 percent of our electricity and does so at about half the cost of any technology that would replace those existing units. The U.S. enjoys electricity priced at about one-half to one-third that of most of Europe. This means more money in the pockets of American consumers, and a competitive edge for U.S. manufacturing in international markets. It would be more than a shame to throw away those enormous economic benefits by reaching beyond our grasp on these two proposed regulations. But we are headed in that direction. (See Appendix B for a compelling presentation of the effect EPA's rulemaking will have on my home state of Texas.) We are already on a path to retire about 20 percent of our existing coal units by 2018, even though many of those units were essential to getting us through last winter's cold waves. And these proposed rules promise to stop any new coal units, while forcing another 20 percent to retire, at least according to EPA. A close study of EPA's technical support documents certainly supports concerns that the system impacts could be much worse.

It is bad enough that EPA's rules will put our nation's electric reliability at risk and significantly increase electricity rates. As somebody who has spent his professional life trying to advance technology, a pill that is almost as bitter to swallow is the fact that EPA has failed to propose a *technology* rule when the problem the President has announced he wants to address will **demand** a *technology* solution.

The President and Administrator McCarthy have said that the problem of global climate change will demand "leadership" from the United States. For years, we were heading down that path by fully funding DOE's public-private partnerships to incubate CCUS so that, one day, the

world's coal fleet would have a technology solution capable of making meaningful progress toward that goal. Yet, now, by simultaneously underfunding CCUS research and implementing regulatory mandates that will hinder, not further, CCUS development, we are not just failing to "lead," we are undermining the world's ability to develop the one technology that has a prayer of addressing the problem.

Technology has benefits to the environment and the economy that don't need to be cut off by EPA rulemaking. We know that the opportunity is out there for CCS, or more accurately CCUS. In the U.S., we have two major projects being undertaken by the private sector to capture carbon from a power plant and use the CO_2 for enhanced oil recovery. One is Southern Company's Kemper County facility in Mississippi, a new facility nearing completion at which the company will gasify lignite, produce a syngas that will be combusted to generate electricity, produce several byproducts like fertilizer and industrial chemicals, and produce a clean CO_2 stream, which will be sold to oilfield companies for enhanced oil recovery. The other is NRG's project at the existing W.R. Parish plant, a post-combustion capture project where the CO_2 again will be used for enhanced oil recovery. This is the kind of technological leadership that needs to be encouraged, not precluded as a consequence – intended or unintended – of environmental policy.

Conclusions

There are four fundamental flaws in the EPA's approach to the three rules proposed and they are the following:

1. Meaningful policy must be both relevant and impactful. DOE has the ability to provide such analysis. Why is it not referenced and included? Interagency collaboration is

anticipated and required. Where is it? From a purely scientific standpoint, the implications of these rules are that:

- They address 0.18% of global CO_2 emissions
- Climate science would equate that to 0.01 degree Celsius of global warming impact
- Resulting impact to sea level is the thickness on four sheets of paper or 1/3 the thickness of a dime
- This rulemaking does not meet the test of meaningful GHG policy

2. Technology capabilities and assumptions made by EPA in unit and system performance are not founded on science and engineering. Notwithstanding the fact that U.S. coal-fired power plants and natural gas-fired facilities are the most efficient in the world, the targets set are clearly beyond achievable targets – especially in a global setting.

3. EPA appears to have approached the challenge with a politically driven end game in mind and worked in reverse to make necessary assumptions to meet targets, including:

- Availability of the necessary infrastructure to enable switching to natural gas from coal.
- Availability of the system and transmission infrastructure to enable renewable and gas replacement of coal.
- Assuming natural gas plant utilization factors unrealistically high.

- Assuming technology insertion when technologies are unproven and not commercially available. I testified nearly a year ago on the absurdity of that assumption that was based on plants not yet build or operational.

4. Environmental policy cannot be developed in a vacuum with energy affordability and security not considered. System reliability will be impacted negatively and analyzing "reserve adequacy" is an incomplete approach that is dangerous to our energy security. Affordability is never mentioned in any manner and estimates range from a low side of two-times to a high side of four-times the average cost to the customer in states most impacted. More troubling in both of the areas is that there is no body of work addressing these issues. Why?

It is all pain for no gain. We need technology to address existing coal and natural gas facilities as the world will double over the next 50 years and in 2060 global energy will still be >80% supplied by coal and natural gas. Forcing this rule on the U.S. will:

- Hobble U.S. competitiveness in the global marketplace.
- Not impact the climate in any meaningful way through rulings on CO_2.
- Not provide technology leadership the rest of the world can follow
- Assure the failure of CCS/CCUS by cutting funding for the development of low cost CCS/CCUS technology

Most importantly, we may be declaring victory against GHG emissions and climate change by majoring on the minor. We are not looking at comprehensive solutions, we cannot achieve environmental or economic success through focusing just on CO_2 for coal-fired power plants.

APPENDIX A

Turbine Upgrade or Efficiency Improvement Projects Cited in NSR Enforcement Initiative

This list is limited to turbine upgrades or replacements – the list would be much longer if improved materials of construction and improved designs of heat transfer surfaces were included.

1. **Turbine Upgrade or Efficiency Improvement Projects Cited in NSR Enforcement Initiative**

- *United States v. Duke Energy Corp.*, No. 00-cv-01262 (M.D.N.C. Dec. 22, 2000) (GE Dense Pack turbine upgrades at Belews Creek Units 1 and 2 and Marshall Unit 3);
- *New York v. Niagara Mohawk Power*, No. 02-CV-24, Compl. (W.D.N.Y. Jan. 10, 2002), ¶ 202 ("upgraded the turbine" on Huntley Unit 63 in 1987), ¶ 323 ("replaced the turbine" on Huntley Unit 67 in 1991);
- *United States v. East Kentucky Coop.*, No. 04-34-KSF, Compl. (E.D. Ky. Jan. 28, 2004), ¶ 60 ("replacement or renovation ... of major components of the ... turbine at the unit" on Dale 4 in 1995-1995), ¶ 76 ("replacements or renovations of major components of the ... turbine" on Dale 3 in 1996);
- *Sierra Club v. Portland General Electric*, No. 08-cv-01136, Am. Compl. (D. Or. Nov. 29, 2010), ¶ 134 ("a plant turbine upgrade" at Boardman in 2003);
- *United States v. Ameren Missouri*, No. 4:11-cv-77, Am. Compl. (E.D. Miss. June 28, 2011), ¶ 67 ("associated turbine replacements" at Rush Island Unit 1 in 2001-2002), ¶ 73 ("associated turbine replacements" at Rush Island Unit 2 in 2003-2004);
- *Conservation Law Foundation, Inc. v. Public Service of New Hampshire*, No. 11-cv-00353, Compl. (D.N.H. July 21, 2011), ¶ 49 ("removed a high pressure/intermediate pressure turbine, and replaced it with a new HP/IP turbine" at Merrimack Unit 2 in 2008);
- *Dine Citizens Against Ruining Our Environment v. Arizona Public Service Company*, No. 1:11-cv-889, Am. Compl. (D.N.M. Jan. 6, 2012), ¶ 48 ("replacement of the high pressure turbines" at Four Corners Units 4 and 5 in 2007), *id.* ("Plaintiffs are informed and believe ... that these high-pressure turbine upgrades increased the design-level heat input rate of each of these units, thereby increasing each unit's generating capacity and its potential to emit air pollution.");
- *United States v. Dairyland Power Coop.*, No. 12-cv-462, Compl. (W.D. Wisc. June 28, 2012), ¶ 38 ("upgrading of the turbine at the J.P Madgett Unit in 2004");
- *Sierra Club v. PPL Montana LLC*, No. 1:13-cv-32, Am. Compl. (D. Mont. Sept. 27, 2013), ¶ 55 ("Replacement of the Low Pressure Turbine" on Unit 3 in 2011), ¶ 57 ("High Pressure/Intermediate Pressure Turbine Replacement" at Unit 2 in 2008), ¶ 58 ("High Pressure Turbine Replacement" at Unit 3 in 2007), ¶ 59 ("High Pressure Turbine Replacement" at Unit 4 in 2006), ¶ 60 ("Replacement of the High Pressure and Intermediate Pressure Turbines" at Unit 1 in 2006).

2. **Standard Turbine Overhauls or other Turbine Projects Cited in NSR Enforcement Initiative**

- *United States v. Cinergy*, No. IP99-1693, Third Am. Compl., (S.D. Ind. June 29, 2006) at ¶ 172 (replacement of "turbine blades" on Beckjord Unit 6 in 1994);
- *United States v. Duke Energy Corp.*, No. 00-cv-01262, Compl. (M.D.N.C. Dec. 22, 2000), ¶ 32 ("turbine overhaul" at Allen Unit 5 in 2000), ¶ 60 ("turbine overhaul" at Allen Unit 4 in 1998), ¶ 195 ("turbine rehabilitation" at Cliffside Unit 4 in 1990);
- *Sierra Club v. Dayton Power & Light, Inc.*, No. C2-04-905, Compl. (S.D. Ohio Sept. 21, 2004), ¶ 43 ("overhaul of the turbine" on Stuart Unit 1 in 1980);
- *United States v. American Electric Power*, No. C2-05-360, Compl. (S.D. Ohio Apr. 8, 2005), ¶ 97 ("replacement of the low pressure turbine rotor" on Conesville Unit 5 in 1997), *id.* ("replacement of the low pressure turbine rotor" on Conesville Unit 6 in 1997);
- *Sierra Club v. PPL Montana LLC*, No. 1:13-cv-32, Am. Compl. (D. Mont. Sept. 27, 2013), ¶¶ 53 ("Low Pressure Turbine Overhaul" at Unit 1 in 2012), *id.* ("Turbine/Generator Base Overhaul" at Unit 1 in 2012), ¶ 54 ("Turbine Generator Base Overhaul" on Unit 2 in 2011), ¶ 55 ("Turbine Generator Base Overhaul" on Unit 3 in 2011), ¶ 55 ("Intermediate Pressure Turbine Overhaul" on Unit 3 in 2011), *id.* ("Turbine/Generator Base Overhaul" on Unit 3 in 2011), ¶ 56 ("LP1 & LP2 Turbine Rebuild" at Unit 4 in 2009), *id.* ("Low Pressure Turbine" at Unit 4 in 2009), *id.* ("Turbine/Generator Base Overhaul" at Unit 2 in 2008), *id.* ("Low Pressure Turbine Overhaul" at Unit 2 in 2008), ¶ 59 ("Intermediate Pressure Turbine Overhaul" at Unit 4 in 2006).

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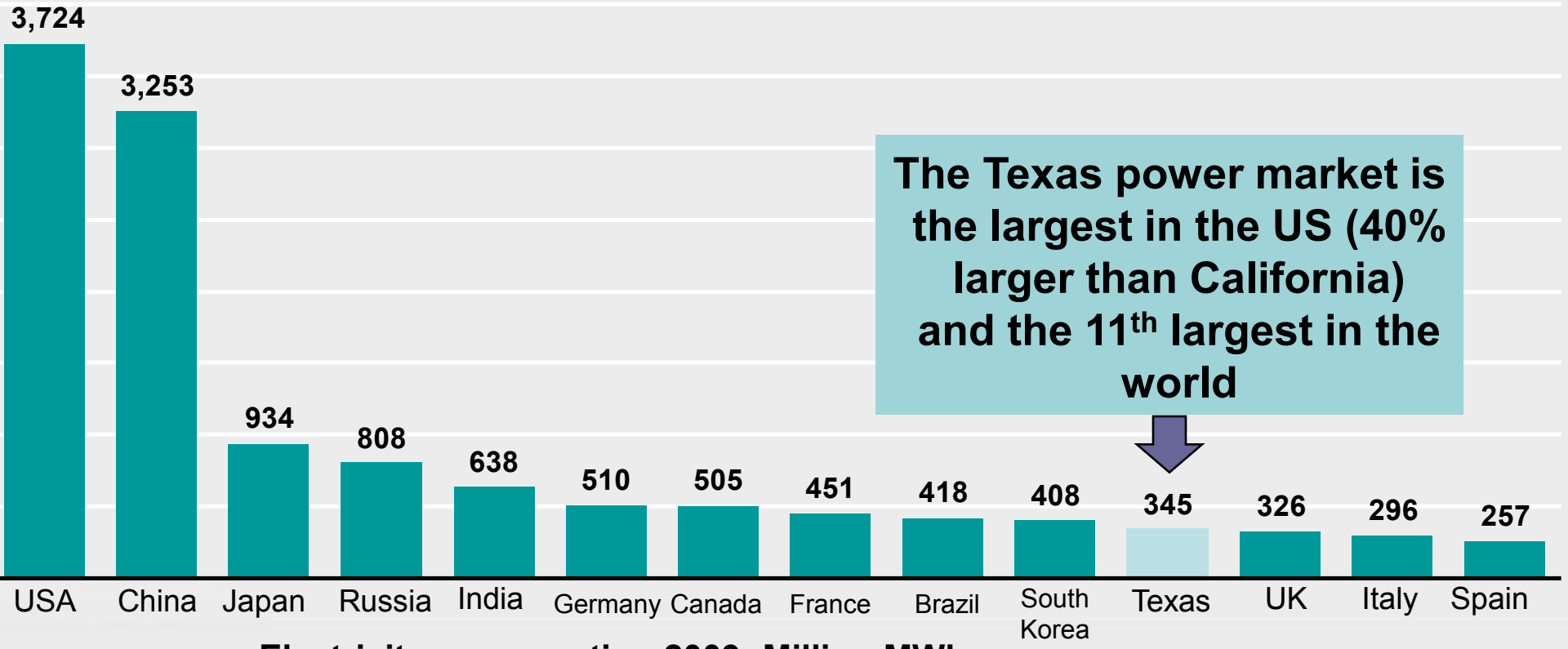
An Assessment of the Impact of EPA's 111(d) Rule (a.k.a. "Clean Power Plan") on Texas

July 7, 2014

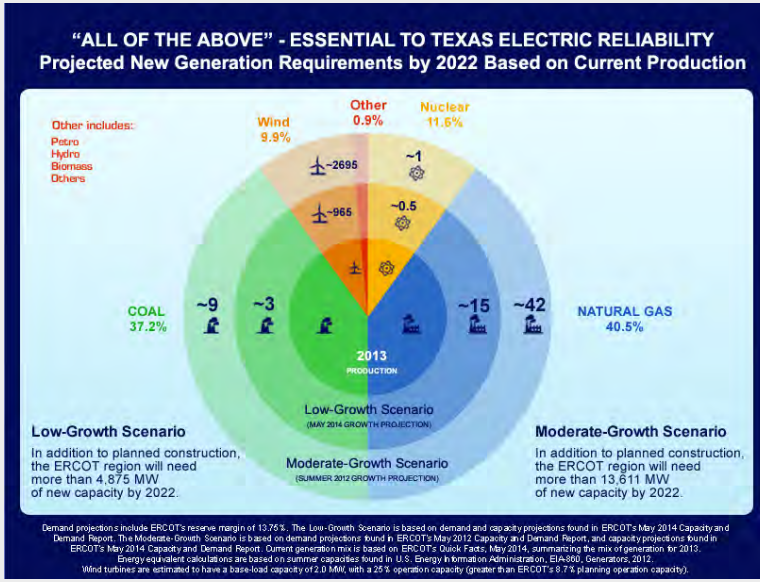
Population, Industry, & Climate Make the Texas Power Market. . .

"Like a Whole Other Country"



NO MEGAWATTS TO SPARE: Texas Uses a Diverse Range of Fuels, Including Coal, to Keep Reliability Up & Cost Down

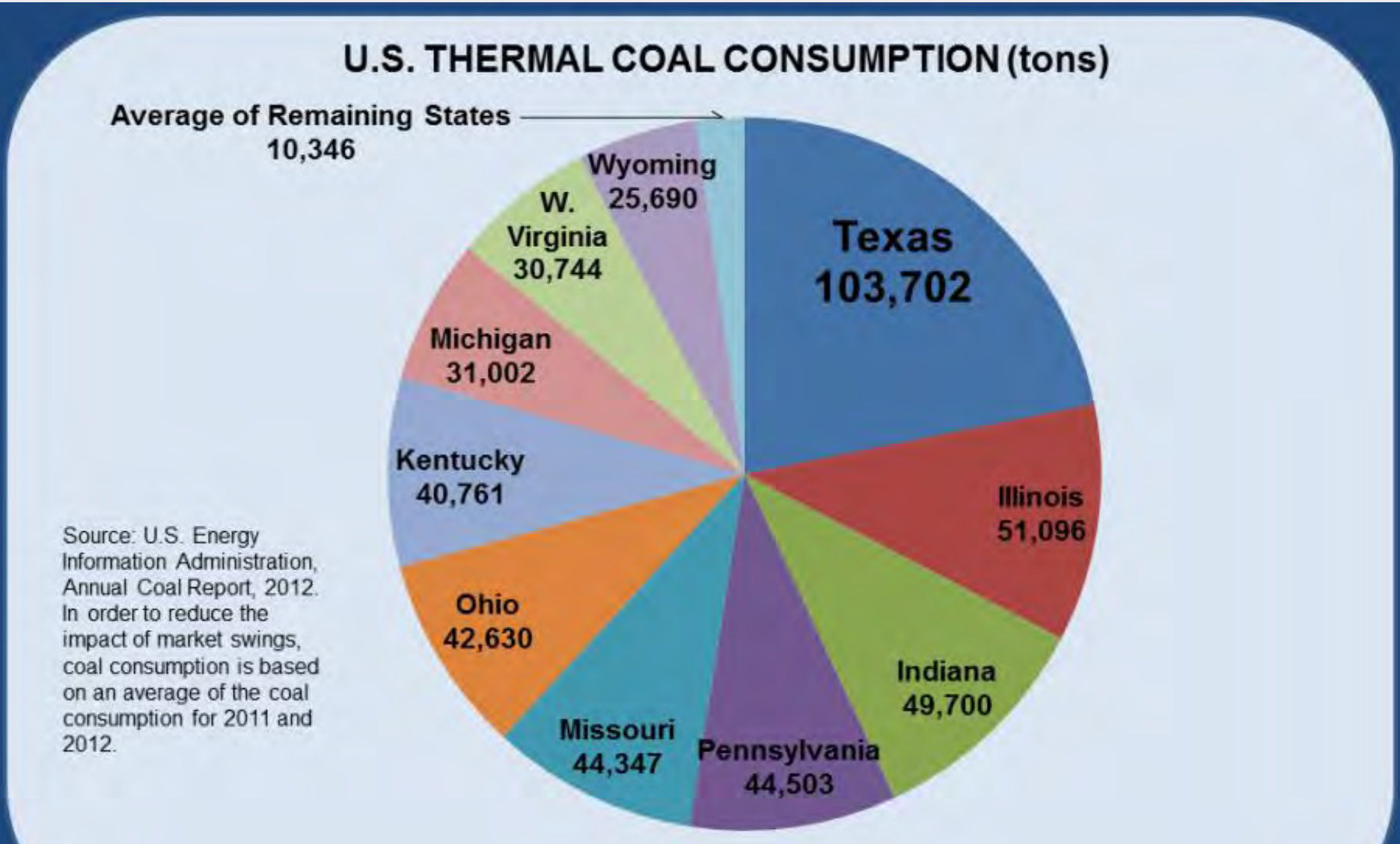
- Texas uses more energy than any other state in the nation, almost as much as the next two states combined (California and Florida).
- *Nearly half of Texas*' electricity use is for industry and manufacturing, which includes the oil & gas and petrochemical industries (more than next 3 states combined).



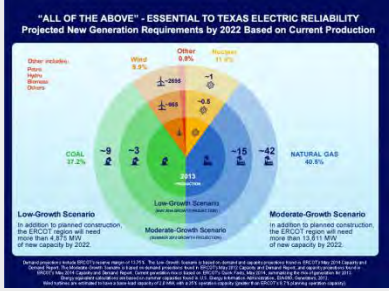
- To keep costs down and production up,Texas uses coal to maintain fuel diversity – accounts for 37-40% of grid

Source: Energy Consumption by End-Use Sector, Ranked by State, 2010 Rankings, U.S. EIA.

Because of its Size, Texas Consumes Twice as Much Coal as Any other State



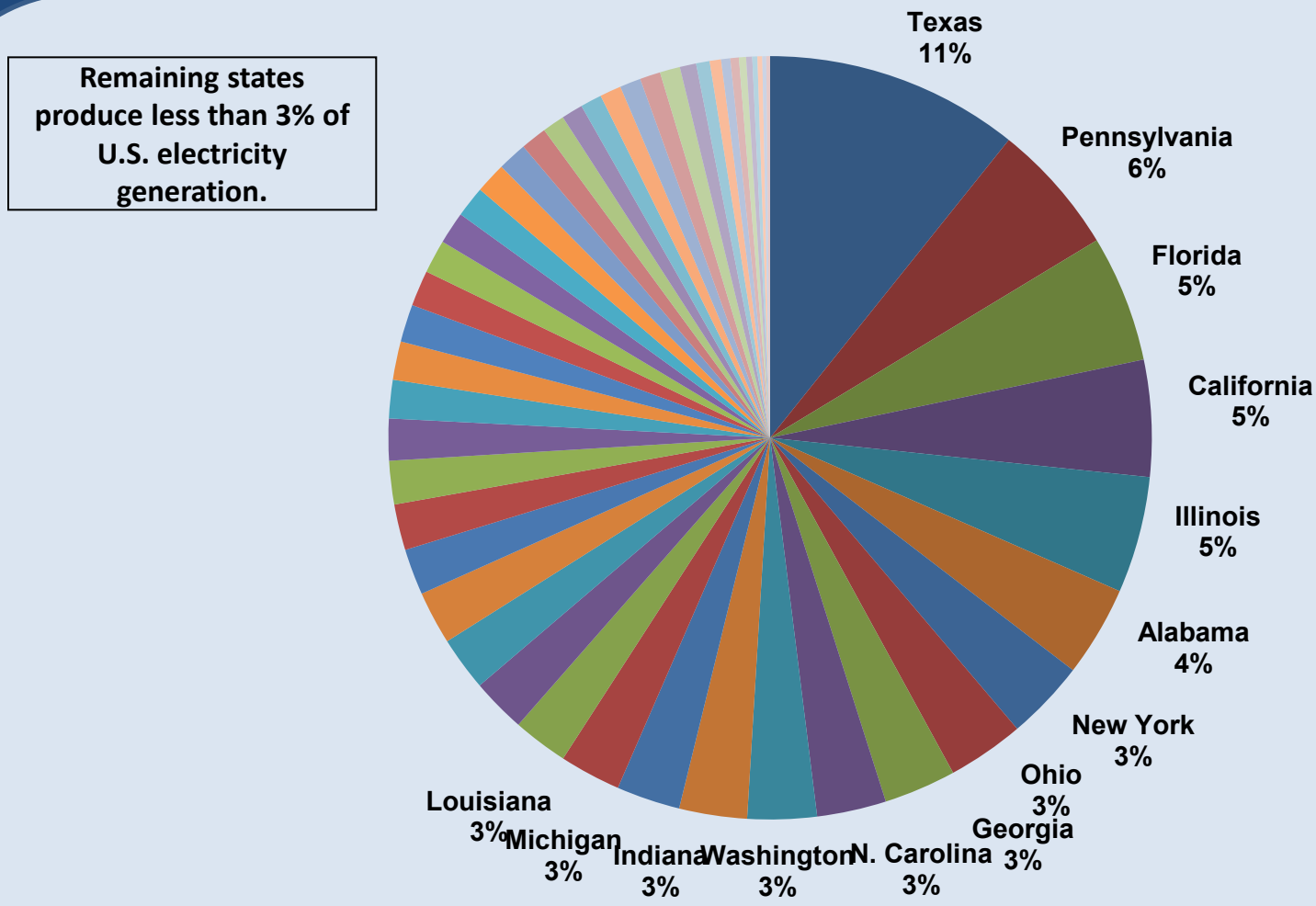
Texas Carrying Disproportionate Burden of EPA Carbon Reductions



- A legitimate claim could be made that Texas should not have to reduce a proportionate share because it produces a majority of our nation's fuels, chemicals and goods (we do everyone's dirty work)
- Yet, when you compare the next two slides, you can see that EPA is not just making Texas carry its share, but almost TWICE its proportionate share (11% of U.S. generation and 18-25% of CO2 reductions)

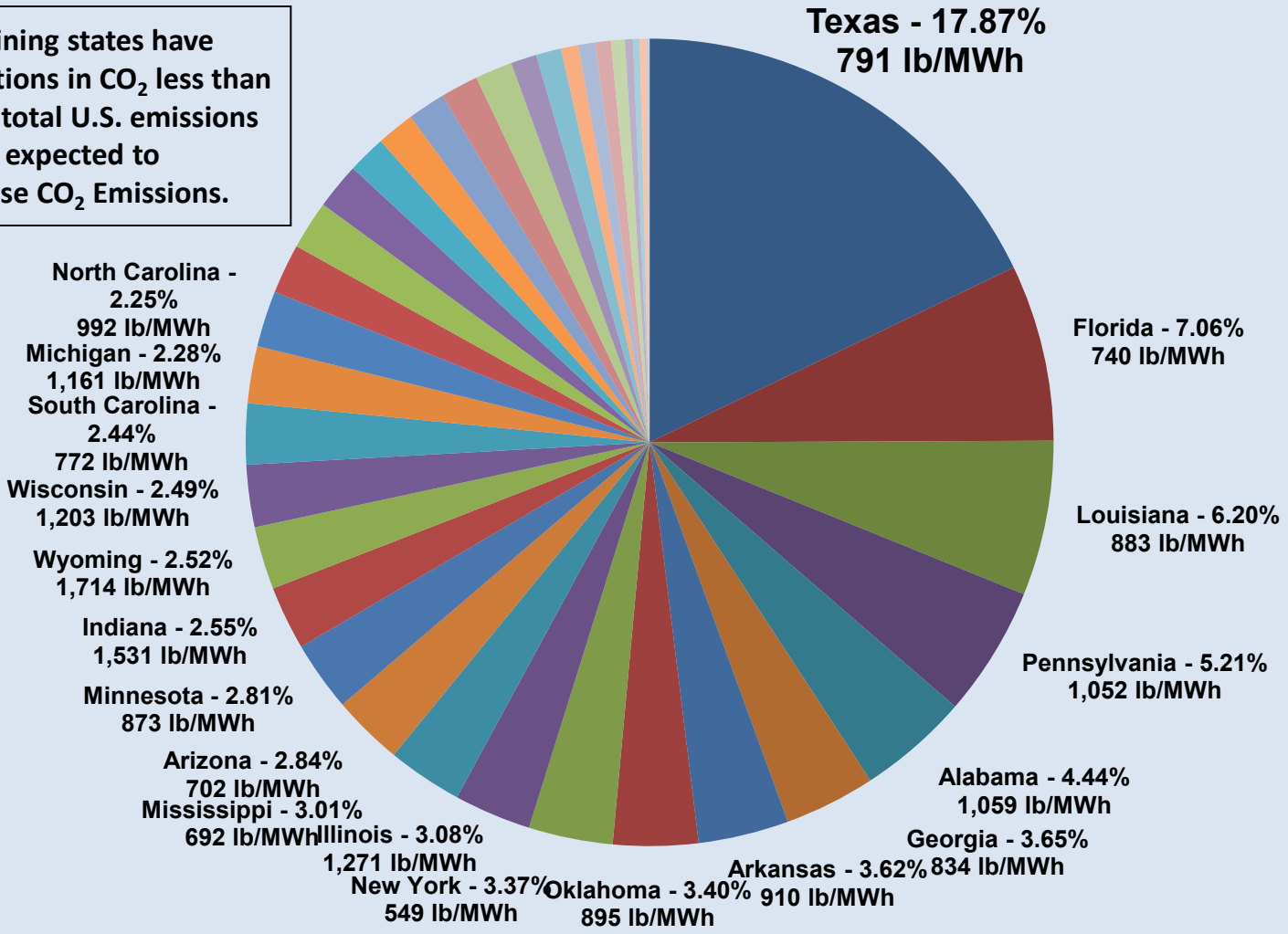
Electricity Production in the United States

Percentage of Total U.S. Production



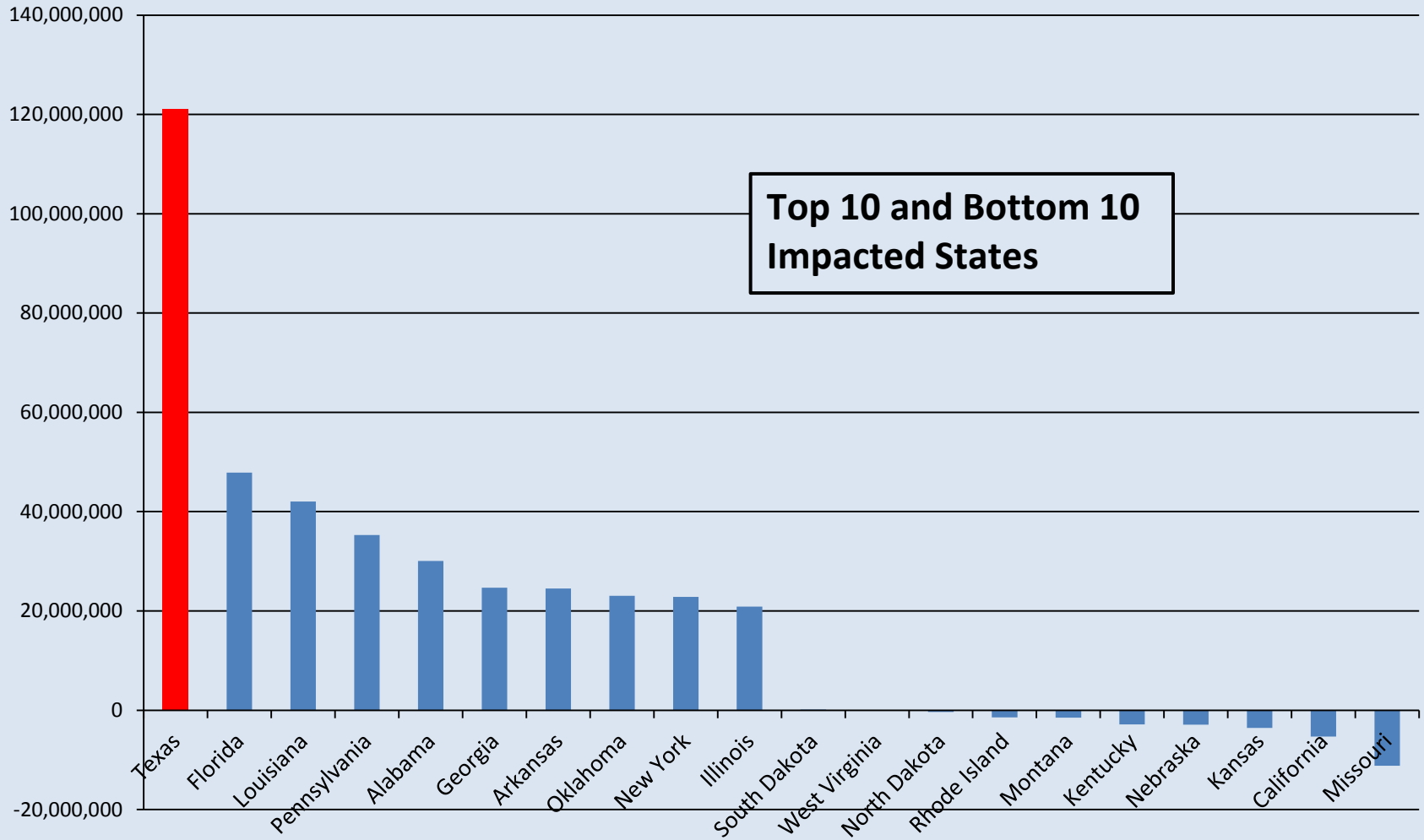
The above graphic demonstrates the share of United States electricity generation by state. Source: EPA's eGrid Database, 2012 Data.

States' Proportion of Total CO_2 Reductions from Electric Generation by 2030 (budgeted rate)



Graph does not include Alaska and Hawaii because data was not available. Vermont is excluded because it is not covered by EPA's rule. The following states were excluded from the graph because they are anticipated to have gains in CO_2 emissions: North Dakota (1.0%), Kentucky (3.0%), California (7.0%), Montana (8.0%), Kansas (10.0%), Nebraska (10.0%), Missouri (14.0%), and Rhode Island (37.0%). Sources: EPA's eGrid 2012 Data & Bloomberg, New Energy Finance analysis (for the rate-to-mass conversion on which percentages are based).

States' CO_2 Reductions from Electric Generation by 2030 (budgeted rate)



Graph does not include Alaska and Hawaii because data was not available. Vermont is excluded because it is not covered by EPA's rule. Sources: EPA's eGrid 2012 Data & Bloomberg, New Energy Finance analysis (for the rate-to-mass conversion on which percentages are based).

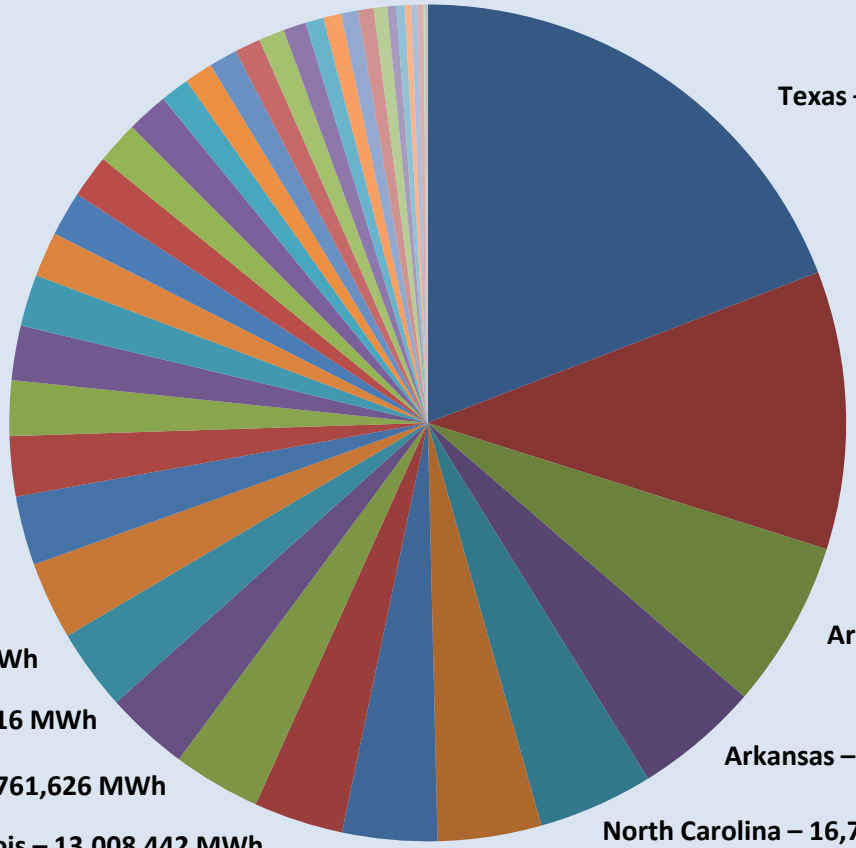
EPA's Modeled Reductions in Coal Generation

All States Impacted By Rule – Final 2030 Target

Remaining state reductions are all below 10,000,000 **MWh.**

* Reductions are based on EPA's assumed coal-to-gas switch and does not include coal retirements driven by: 1) regulatory uncertainty, 2) EPA's 6% additional coal-targeted emissions reductions, or market disadvantages resulting from functionally creating a price on carbon.

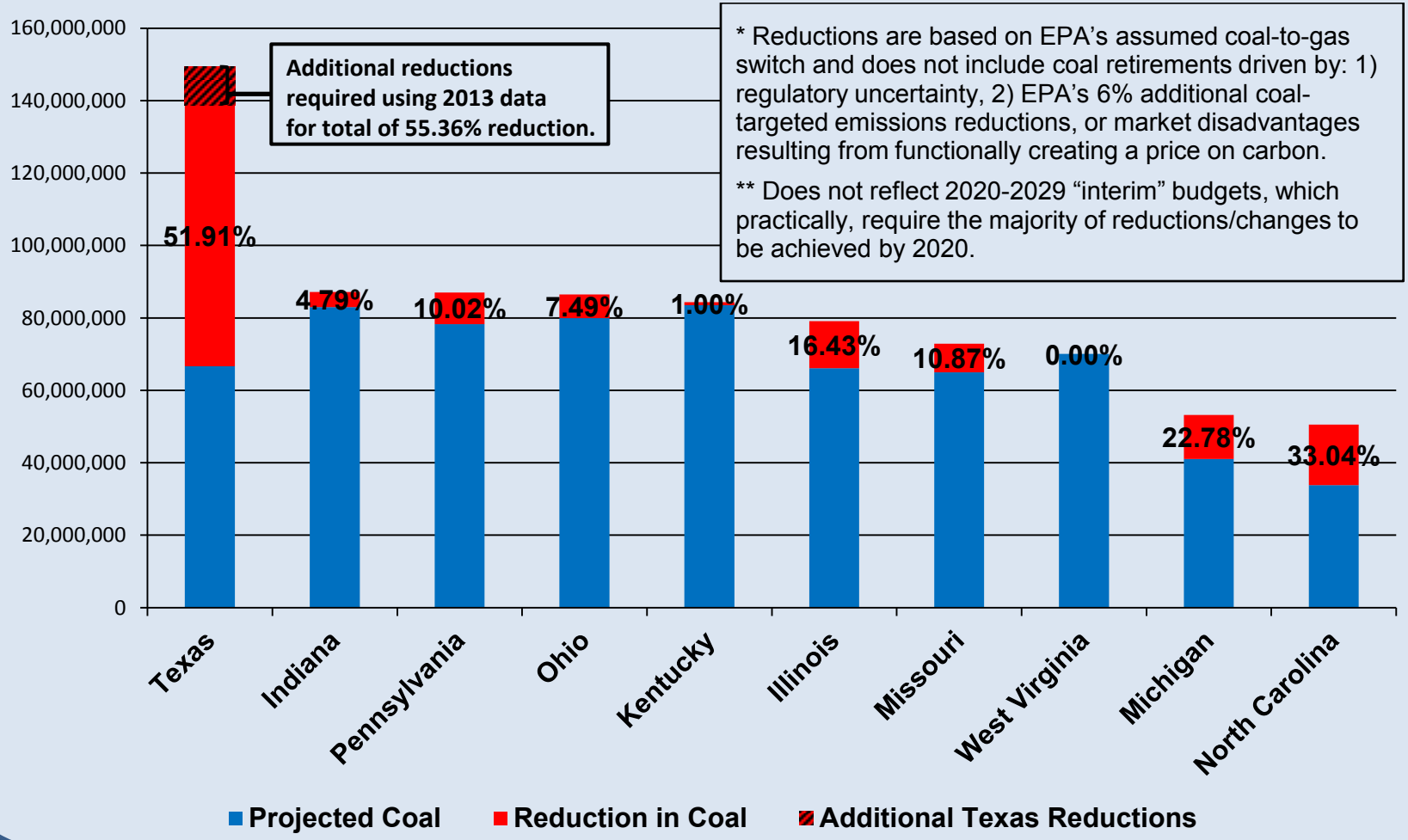
** Does not reflect 2020-2029 "interim" budgets, which practically, require the majority of reductions/changes to be achieved by 2020.



Modeled reductions are shown in megawatt-hours (MWh), comparing 2012 data to EPA's projected 2030 target. Texas is projected to reduce coal generation from 138,705,138 MWh in 2012 to 66,698,233 MWh in 2030 – a reduction of 51.91%. In 2013, Texas coal generation actually reached 149,404,244 MWh, which would result in a difference of 82,706,011 (55.36%) to meet EPA's 2030 target. The above graphic does not include Idaho, Maine, Rhode Island, and Vermont, which do not have coal generation.

EPA's Modeled Reductions in Coal Generation

Comparison of Top 10 Generators of Coal Electricity – Final 2030 Target



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EPA's Modeled Increases in Renewable Electricity

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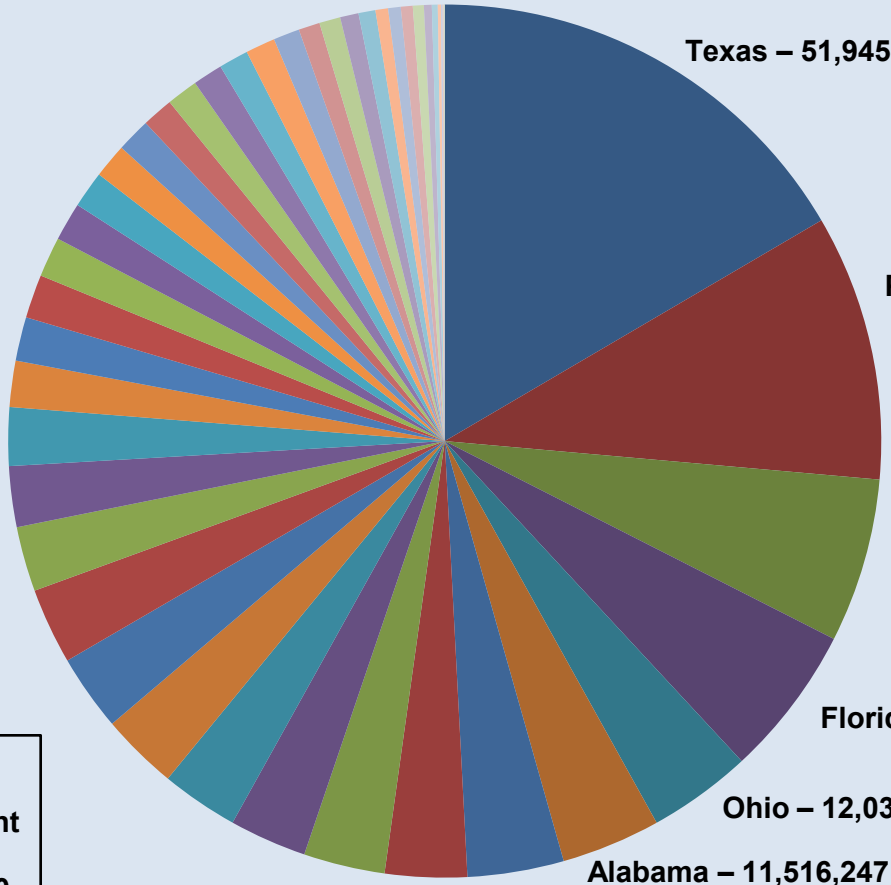

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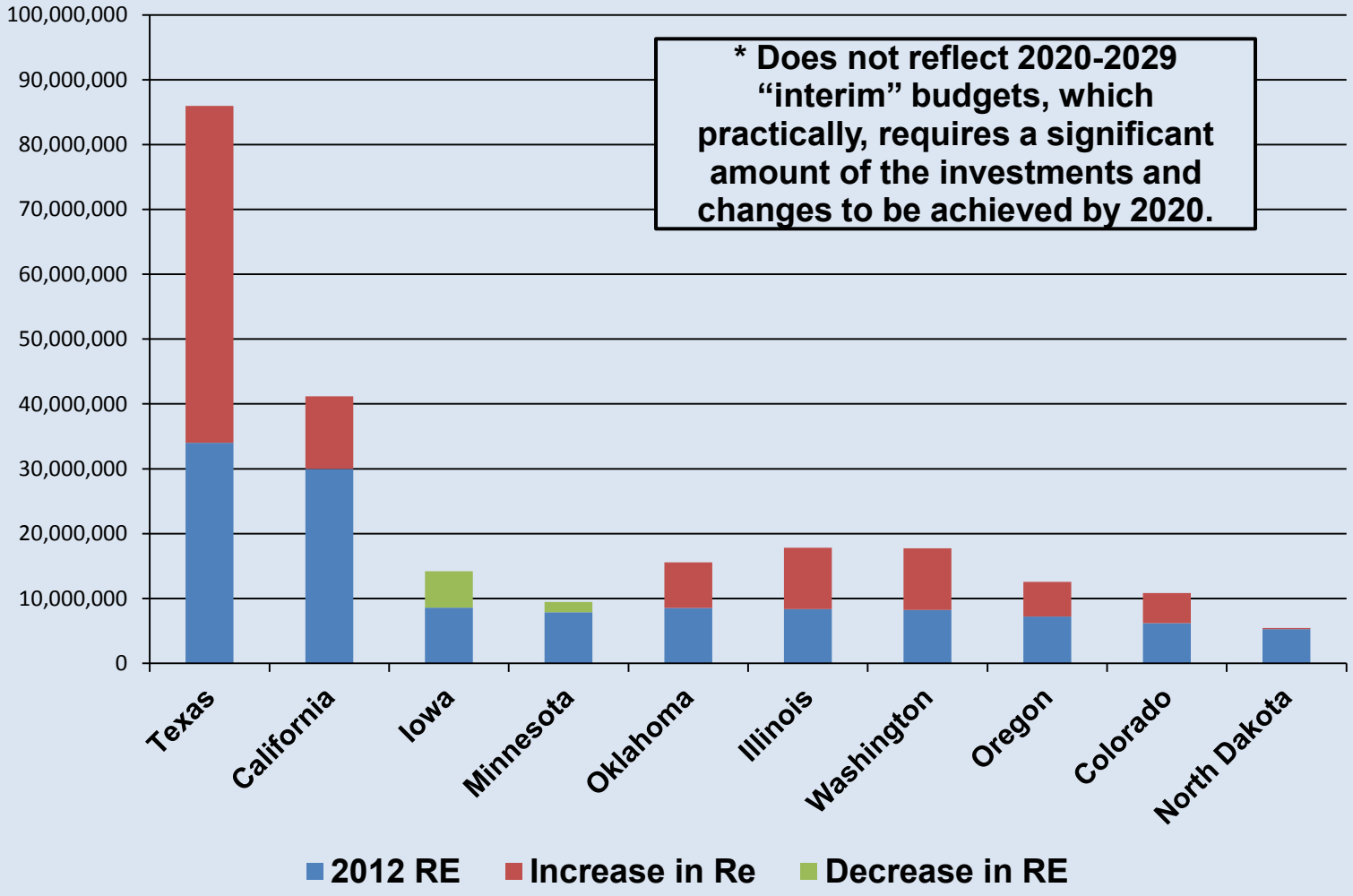
EPA's Modeled Increases in Renewable Electricity (Top Ten Producers)



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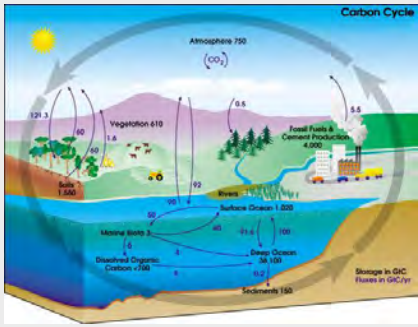
Texas WILL Fight EPA's Illegal Re-Engineering of our Fleet

- EPA claims states have "flexibility" but the reality of mandated state budgets strictly limit options available to states
- Majority of the rule's reductions come "outside the fence" by assuming fuel-switching & build-out of renewables & efficiency
- Disparate impact on Texas will strike at the heart of the U.S. production of fuels, chemicals, and manufactured goods.
- SIP disapprovals & FIPs could result in unprecedented clash between EPA and states ("Come and Take it")
- Immediate task is to build case for irreparable harm & political intervention to keep the rule from coming into effect

EPA'S Carbon Rule is "All Pain – No Gain"



(based on EPA analysis/methodology in light duty vehicle rule and assuming accuracy IPCC projections):

- Addresses only 0.18% of world's CO_2 emissions.
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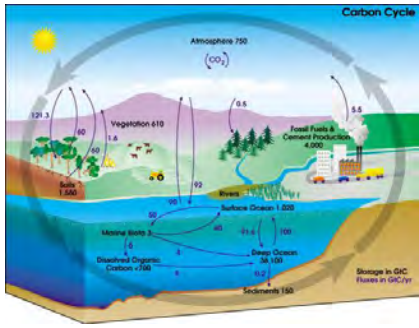


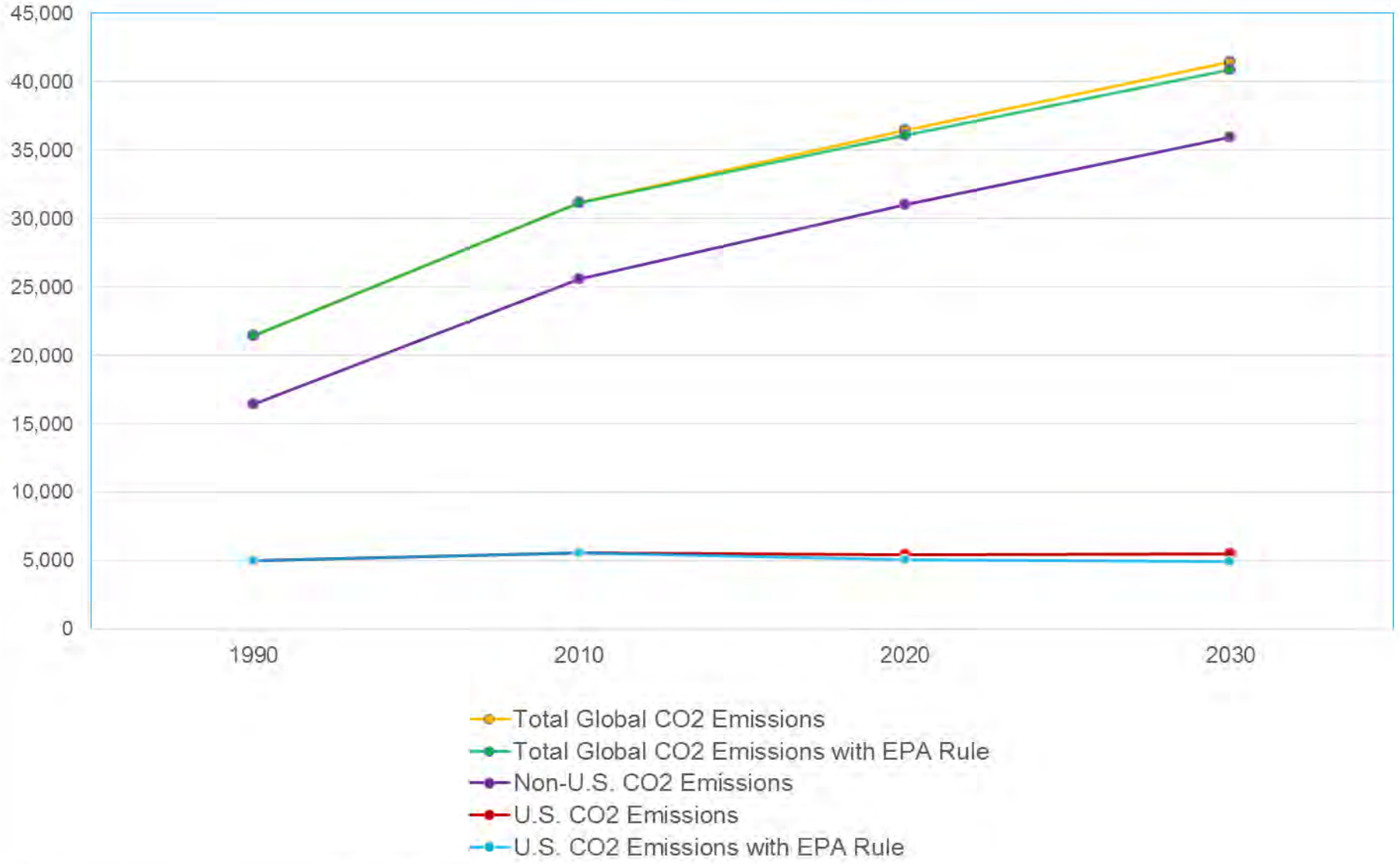
No Gain

(due to World energy realities)

- Non-U.S. CO_2 emissions are projected to increase 55 percent between 2010 and 2040.
- Between 2011 and 2030, annual non-U.S. power sector carbon emissions are projected to increase by 4,692 million tons
- BOTTOM LINE: 111(d) rule reductions will be offset **more than 8 times over by developing nations.**

U.S. and Global Carbon Emissions Projections

(million metric tons)



Source: EPA Carbon Regulation Proposal, pg 547-548, and www.eia.gov/forecasts/ieo/table21.cfm

APPENDIX A

Turbine Upgrade or Efficiency Improvement Projects Cited in NSR Enforcement Initiative

This list is limited to turbine upgrades or replacements – the list would be much longer if improved materials of construction and improved designs of heat transfer surfaces were included.

1. **Turbine Upgrade or Efficiency Improvement Projects Cited in NSR Enforcement Initiative**

- *United States v. Duke Energy Corp.*, No. 00-cv-01262 (M.D.N.C. Dec. 22, 2000) (GE Dense Pack turbine upgrades at Belews Creek Units 1 and 2 and Marshall Unit 3);
- *New York v. Niagara Mohawk Power*, No. 02-CV-24, Compl. (W.D.N.Y. Jan. 10, 2002), ¶ 202 ("upgraded the turbine" on Huntley Unit 63 in 1987), ¶ 323 ("replaced the turbine" on Huntley Unit 67 in 1991);
- *United States v. East Kentucky Coop.*, No. 04-34-KSF, Compl. (E.D. Ky. Jan. 28, 2004), ¶ 60 ("replacement or renovation ... of major components of the ... turbine at the unit" on Dale 4 in 1995-1995), ¶ 76 ("replacements or renovations of major components of the ... turbine" on Dale 3 in 1996);
- *Sierra Club v. Portland General Electric*, No. 08-cv-01136, Am. Compl. (D. Or. Nov. 29, 2010), ¶ 134 ("a plant turbine upgrade" at Boardman in 2003);
- *United States v. Ameren Missouri*, No. 4:11-cv-77, Am. Compl. (E.D. Miss. June 28, 2011), ¶ 67 ("associated turbine replacements" at Rush Island Unit 1 in 2001-2002), ¶ 73 ("associated turbine replacements" at Rush Island Unit 2 in 2003-2004);
- *Conservation Law Foundation, Inc. v. Public Service of New Hampshire*, No. 11-cv-00353, Compl. (D.N.H. July 21, 2011), ¶ 49 ("removed a high pressure/intermediate pressure turbine, and replaced it with a new HP/IP turbine" at Merrimack Unit 2 in 2008);
- *Dine Citizens Against Ruining Our Environment v. Arizona Public Service Company*, No. 1:11-cv-889, Am. Compl. (D.N.M. Jan. 6, 2012), ¶ 48 ("replacement of the high pressure turbines" at Four Corners Units 4 and 5 in 2007), *id.* ("Plaintiffs are informed and believe ... that these high-pressure turbine upgrades increased the design-level heat input rate of each of these units, thereby increasing each unit's generating capacity and its potential to emit air pollution.");
- *United States v. Dairyland Power Coop.*, No. 12-cv-462, Compl. (W.D. Wisc. June 28, 2012), ¶ 38 ("upgrading of the turbine at the J.P Madgett Unit in 2004");
- *Sierra Club v. PPL Montana LLC*, No. 1:13-cv-32, Am. Compl. (D. Mont. Sept. 27, 2013), ¶ 55 ("Replacement of the Low Pressure Turbine" on Unit 3 in 2011), ¶ 57 ("High Pressure/Intermediate Pressure Turbine Replacement" at Unit 2 in 2008), ¶ 58 ("High Pressure Turbine Replacement" at Unit 3 in 2007), ¶ 59 ("High Pressure Turbine Replacement" at Unit 4 in 2006), ¶ 60 ("Replacement of the High Pressure and Intermediate Pressure Turbines" at Unit 1 in 2006).

2. **Standard Turbine Overhauls or other Turbine Projects Cited in NSR Enforcement Initiative**

- *United States v. Cinergy*, No. IP99-1693, Third Am. Compl., (S.D. Ind. June 29, 2006) at ¶ 172 (replacement of "turbine blades" on Beckjord Unit 6 in 1994);
- *United States v. Duke Energy Corp.*, No. 00-cv-01262, Compl. (M.D.N.C. Dec. 22, 2000), ¶ 32 ("turbine overhaul" at Allen Unit 5 in 2000), ¶ 60 ("turbine overhaul" at Allen Unit 4 in 1998), ¶ 195 ("turbine rehabilitation" at Cliffside Unit 4 in 1990);
- *Sierra Club v. Dayton Power & Light, Inc.*, No. C2-04-905, Compl. (S.D. Ohio Sept. 21, 2004), ¶ 43 ("overhaul of the turbine" on Stuart Unit 1 in 1980);
- *United States v. American Electric Power*, No. C2-05-360, Compl. (S.D. Ohio Apr. 8, 2005), ¶ 97 ("replacement of the low pressure turbine rotor" on Conesville Unit 5 in 1997), *id.* ("replacement of the low pressure turbine rotor" on Conesville Unit 6 in 1997);
- *Sierra Club v. PPL Montana LLC*, No. 1:13-cv-32, Am. Compl. (D. Mont. Sept. 27, 2013), ¶¶ 53 ("Low Pressure Turbine Overhaul" at Unit 1 in 2012), *id.* ("Turbine/Generator Base Overhaul" at Unit 1 in 2012), ¶ 54 ("Turbine Generator Base Overhaul" on Unit 2 in 2011), ¶ 55 ("Turbine Generator Base Overhaul" on Unit 3 in 2011), ¶ 55 ("Intermediate Pressure Turbine Overhaul" on Unit 3 in 2011), *id.* ("Turbine/Generator Base Overhaul" on Unit 3 in 2011), ¶ 56 ("LP1 & LP2 Turbine Rebuild" at Unit 4 in 2009), *id.* ("Low Pressure Turbine" at Unit 4 in 2009), *id.* ("Turbine/Generator Base Overhaul" at Unit 2 in 2008), *id.* ("Low Pressure Turbine Overhaul" at Unit 2 in 2008), ¶ 59 ("Intermediate Pressure Turbine Overhaul" at Unit 4 in 2006).

Mike Nasi

Jackson Walker L.L.P.
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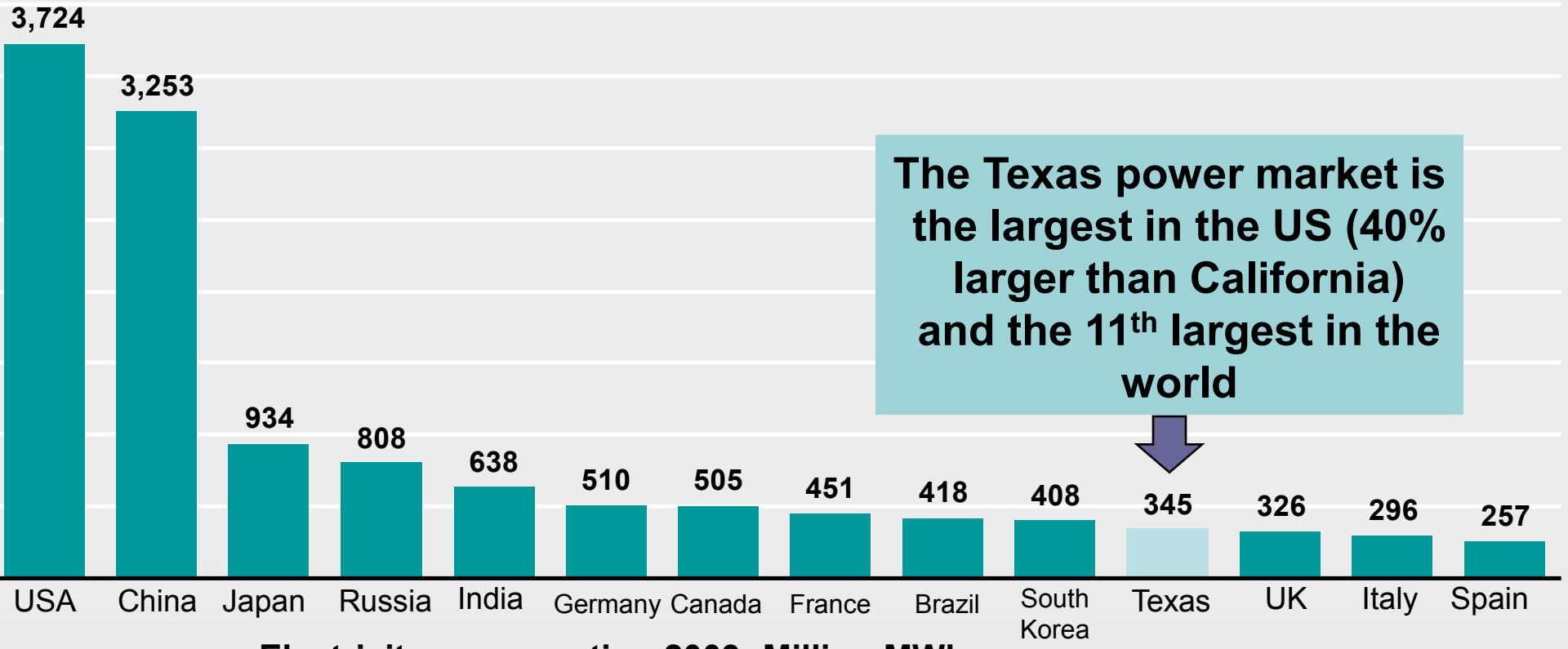
512.236.2216

An Assessment of the Impact of EPA's 111(d) Rule (a.k.a. "Clean Power Plan") on Texas

July 7, 2014

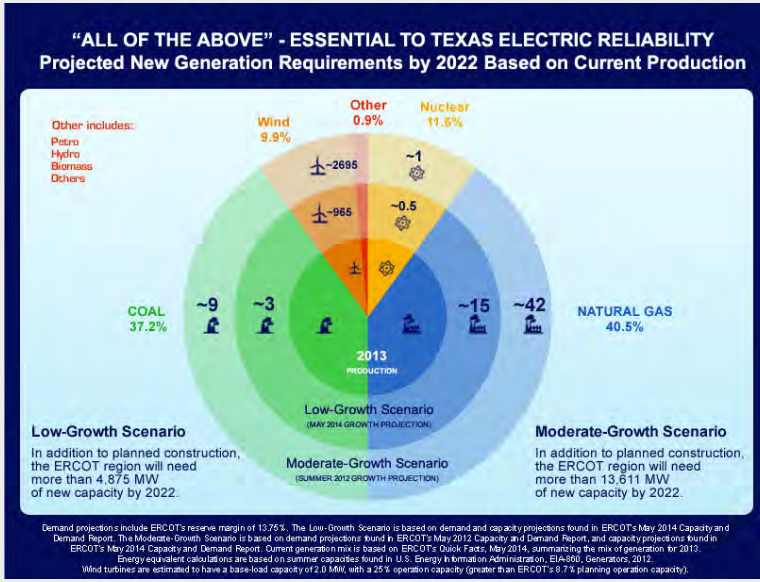
Population, Industry, & Climate Make the Texas Power Market. . .

"Like a Whole Other Country"



NO MEGAWATTS TO SPARE: Texas Uses a Diverse Range of Fuels, Including Coal, to Keep Reliability Up & Cost Down

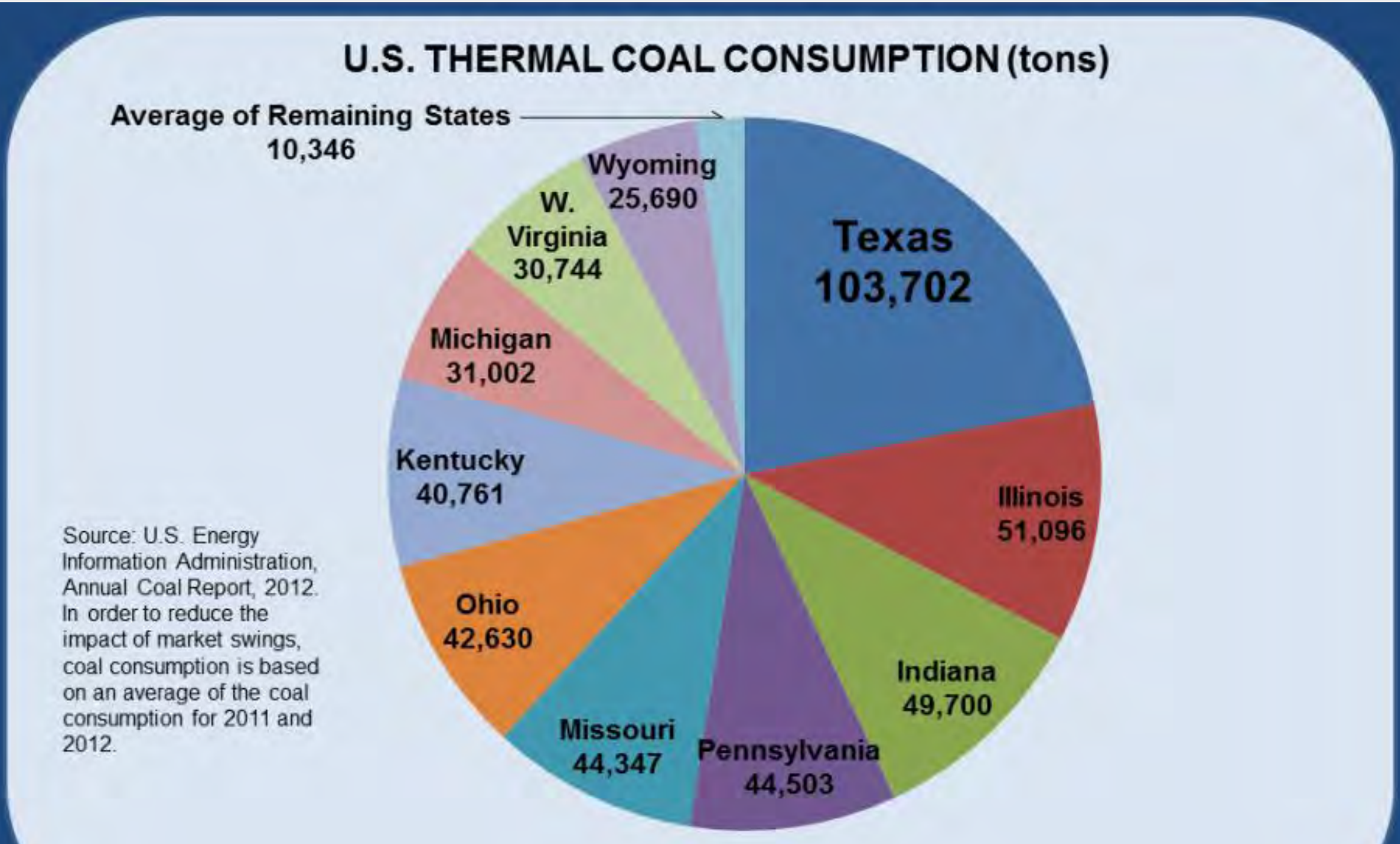
- Texas uses more energy than any other state in the nation, almost as much as the next two states combined (California and Florida).
- *Nearly half of Texas*' electricity use is for industry and manufacturing, which includes the oil & gas and petrochemical industries (more than next 3 states combined).



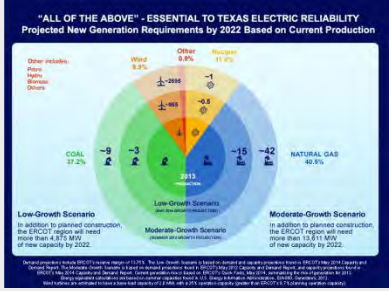
- To keep costs down and production up,Texas uses coal to maintain fuel diversity – accounts for 37-40% of grid

Source: Energy Consumption by End-Use Sector, Ranked by State, 2010 Rankings, U.S. EIA.

Because of its Size, Texas Consumes Twice as Much Coal as Any other State



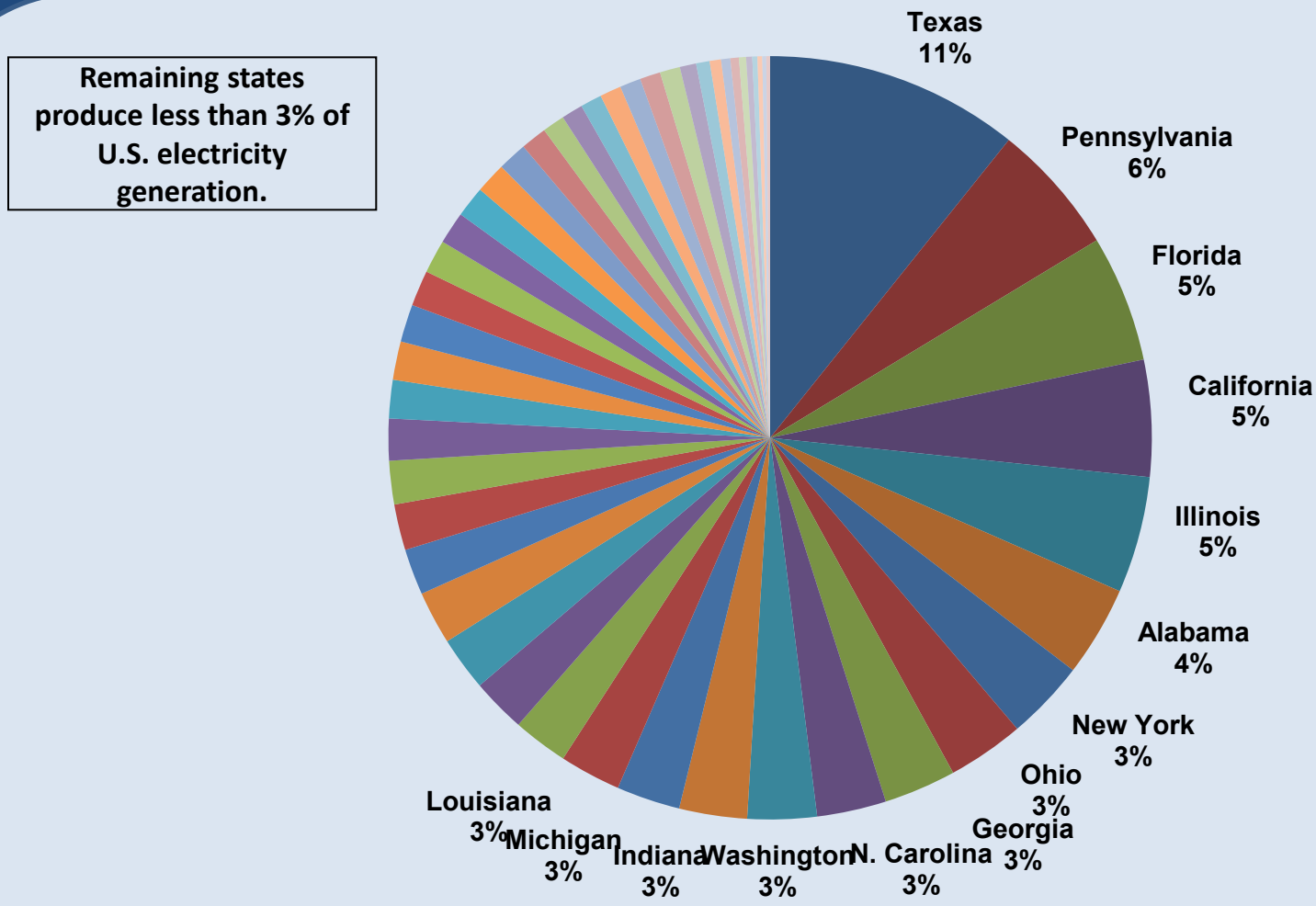
Texas Carrying Disproportionate Burden of EPA Carbon Reductions



- A legitimate claim could be made that Texas should not have to reduce a proportionate share because it produces a majority of our nation's fuels, chemicals and goods (we do everyone's dirty work)
- Yet, when you compare the next two slides, you can see that EPA is not just making Texas carry its share, but almost TWICE its proportionate share (11% of U.S. generation and 18-25% of CO2 reductions)

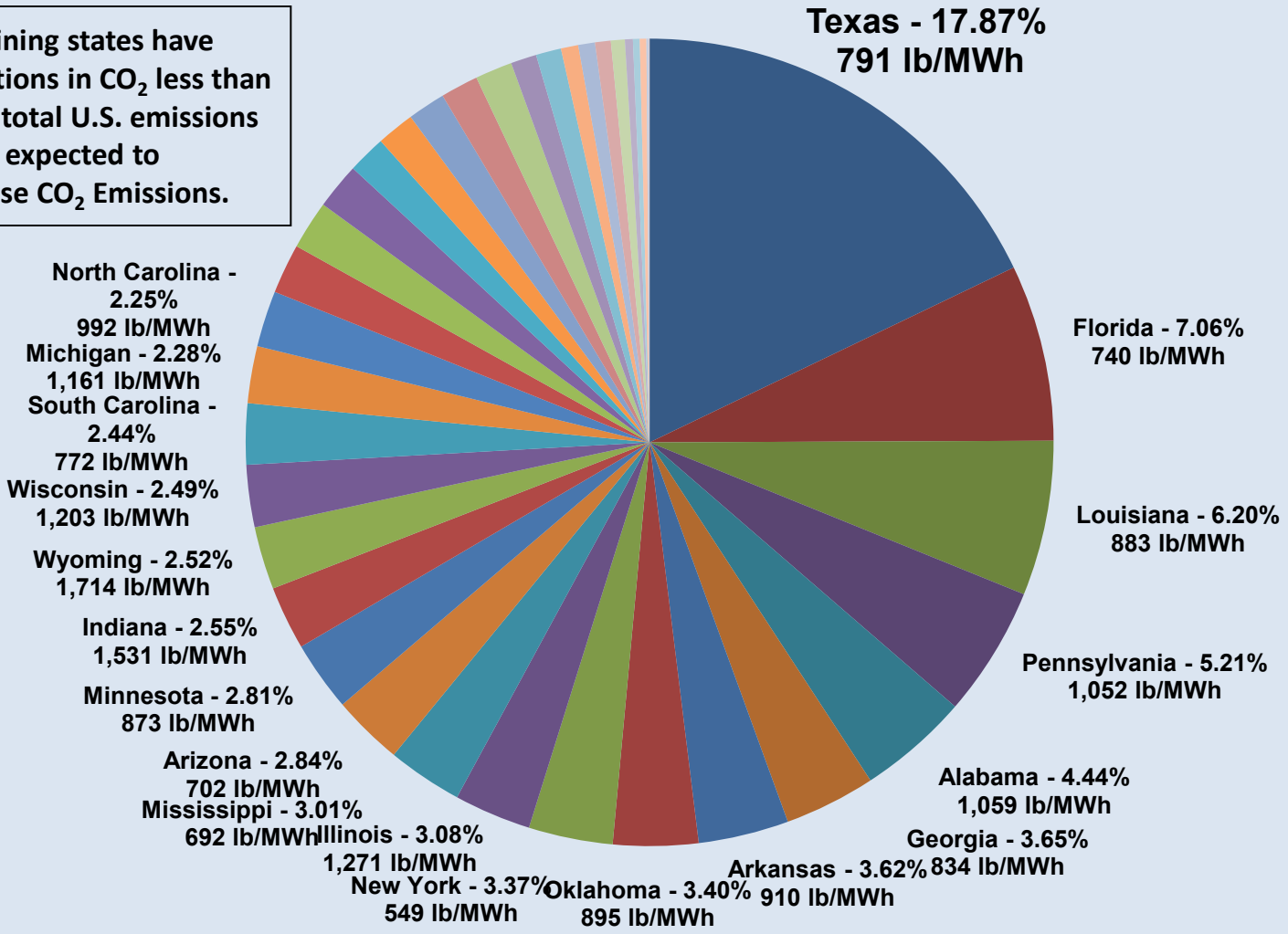
Electricity Production in the United States

Percentage of Total U.S. Production



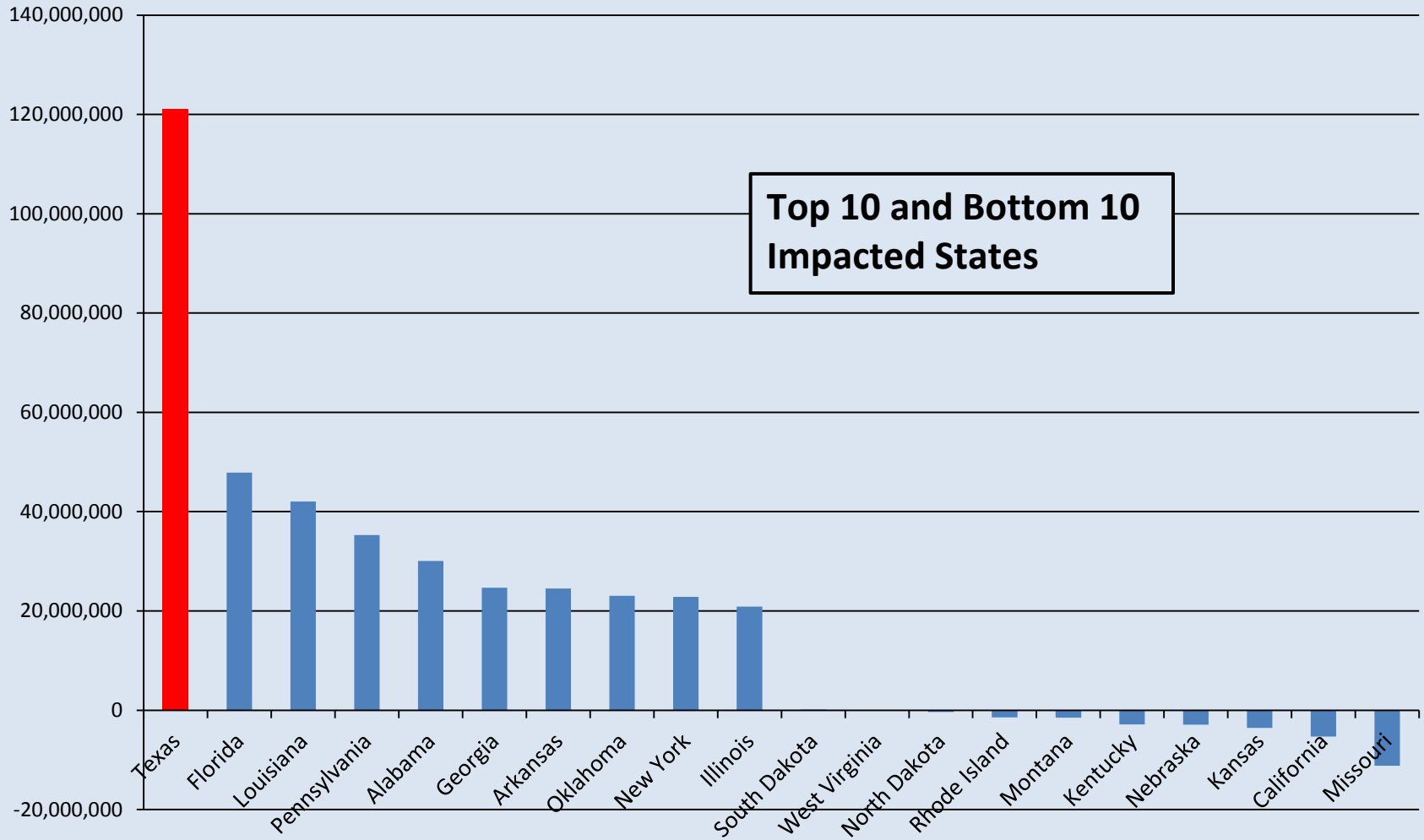
The above graphic demonstrates the share of United States electricity generation by state. Source: EPA's eGrid Database, 2012 Data.

States' Proportion of Total CO_2 Reductions from Electric Generation by 2030 (budgeted rate)



Graph does not include Alaska and Hawaii because data was not available. Vermont is excluded because it is not covered by EPA's rule. The following states were excluded from the graph because they are anticipated to have gains in CO_2 emissions: North Dakota (1.0%), Kentucky (3.0%), California (7.0%), Montana (8.0%), Kansas (10.0%), Nebraska (10.0%), Missouri (14.0%), and Rhode Island (37.0%). Sources: EPA's eGrid 2012 Data & Bloomberg, New Energy Finance analysis (for the rate-to-mass conversion on which percentages are based).

States' CO_2 Reductions from Electric Generation by 2030 (budgeted rate)



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EPA's Modeled Reductions in Coal Generation

All States Impacted By Rule – Final 2030 Target

Remaining state reductions are all below 10,000,000 **MWh.**

* Reductions are based on EPA's assumed coal-to-gas switch and does not include coal retirements driven by: 1) regulatory uncertainty, 2) EPA's 6% additional coal-targeted emissions reductions, or market disadvantages resulting from functionally creating a price on carbon.

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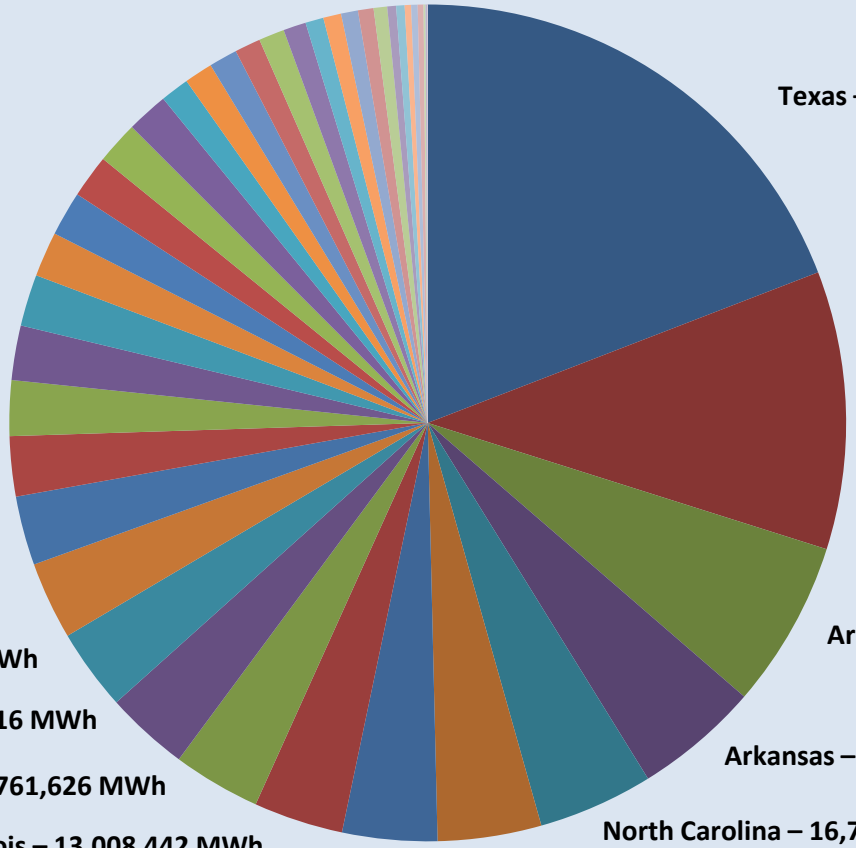

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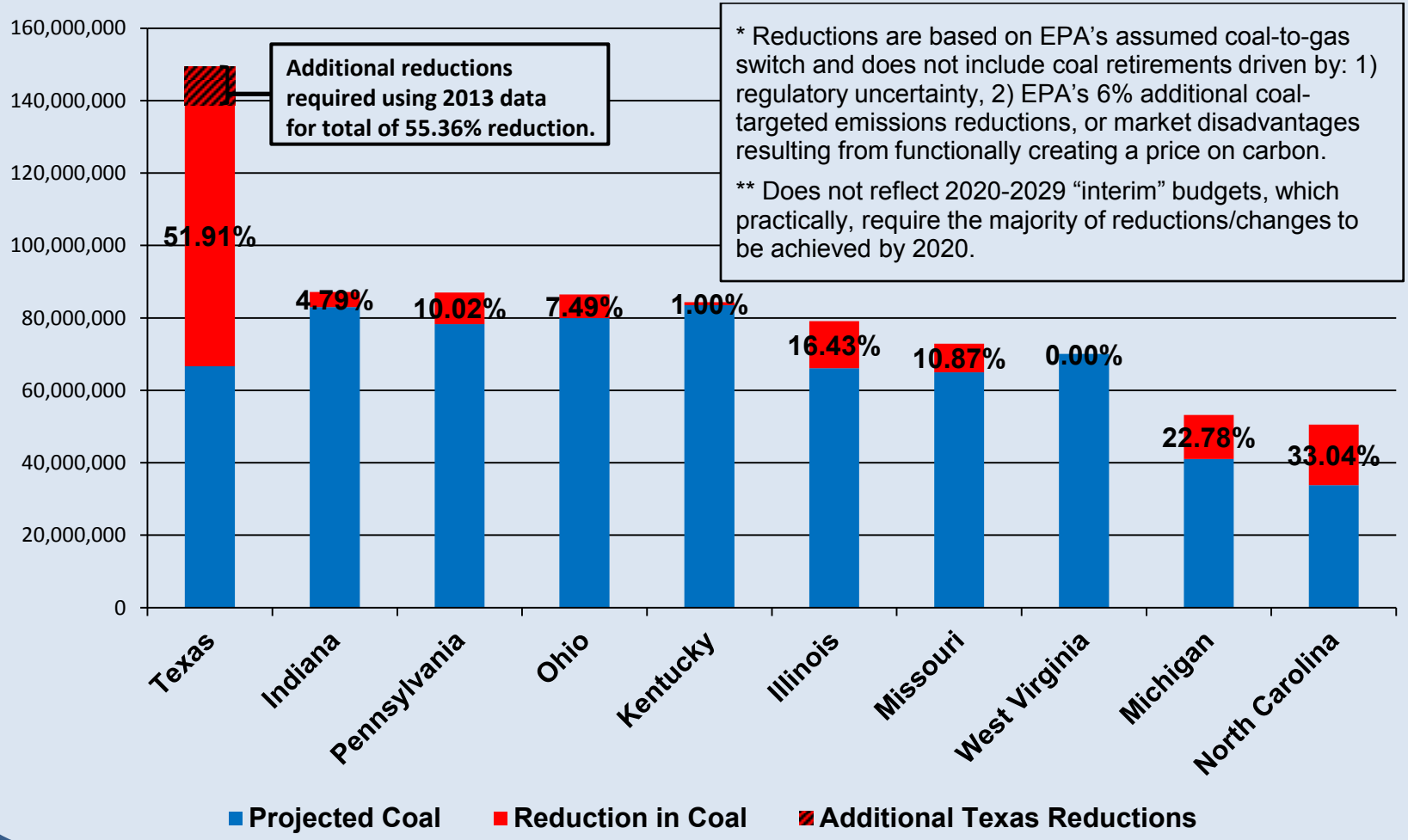

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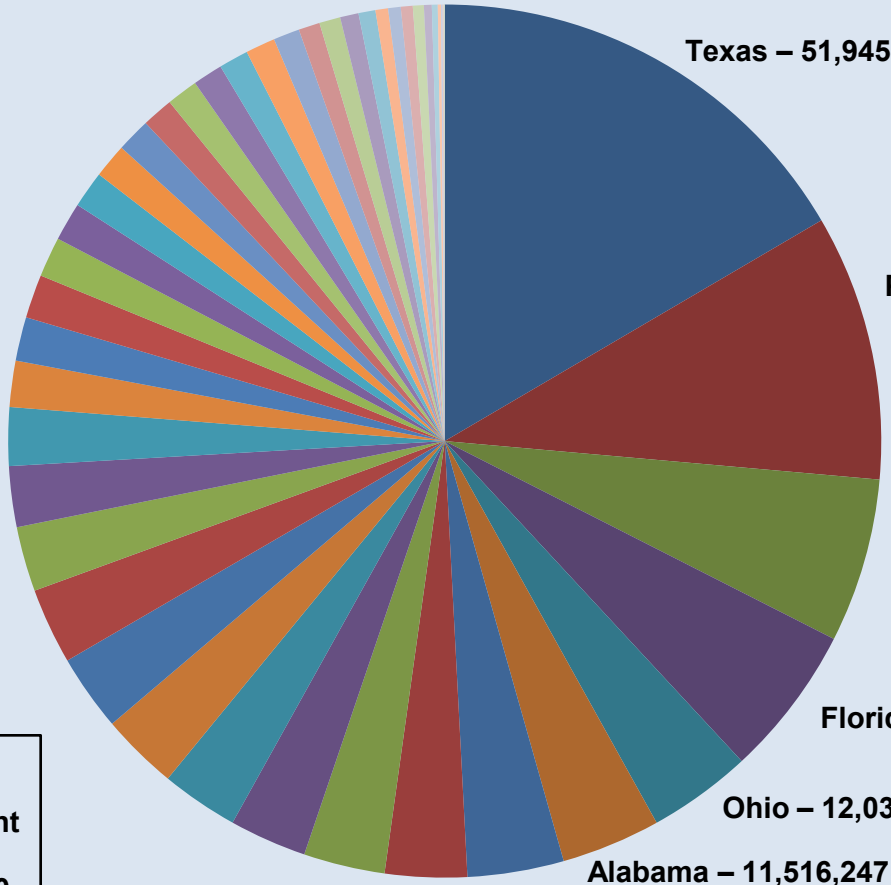

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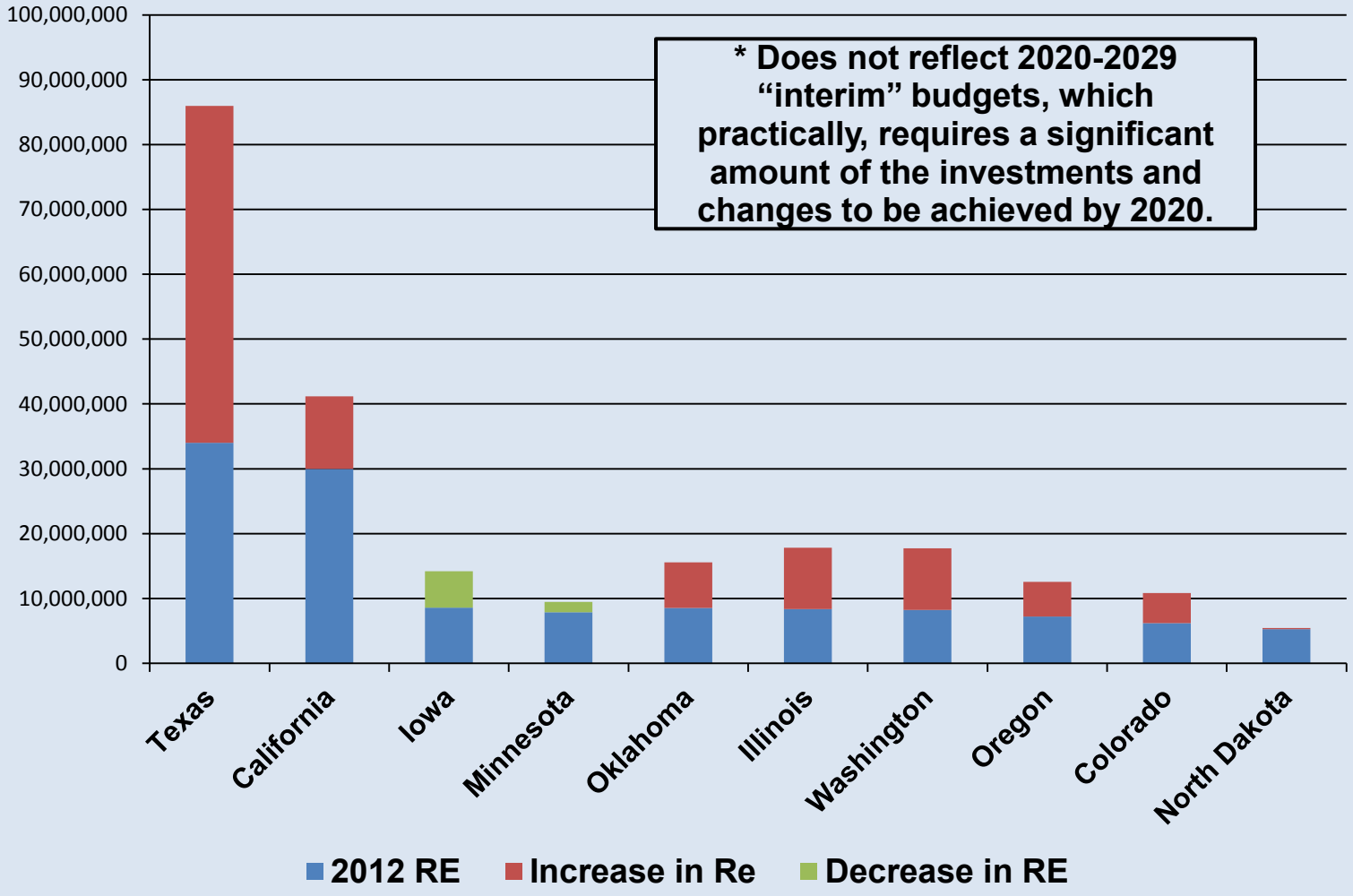

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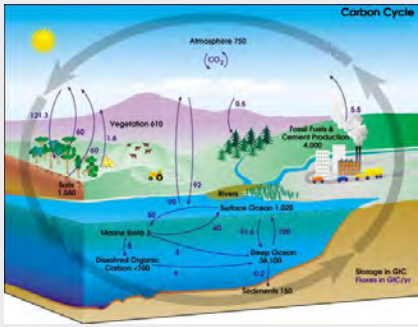

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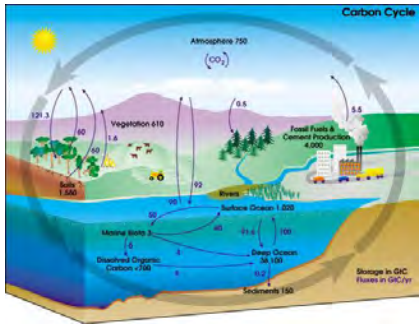

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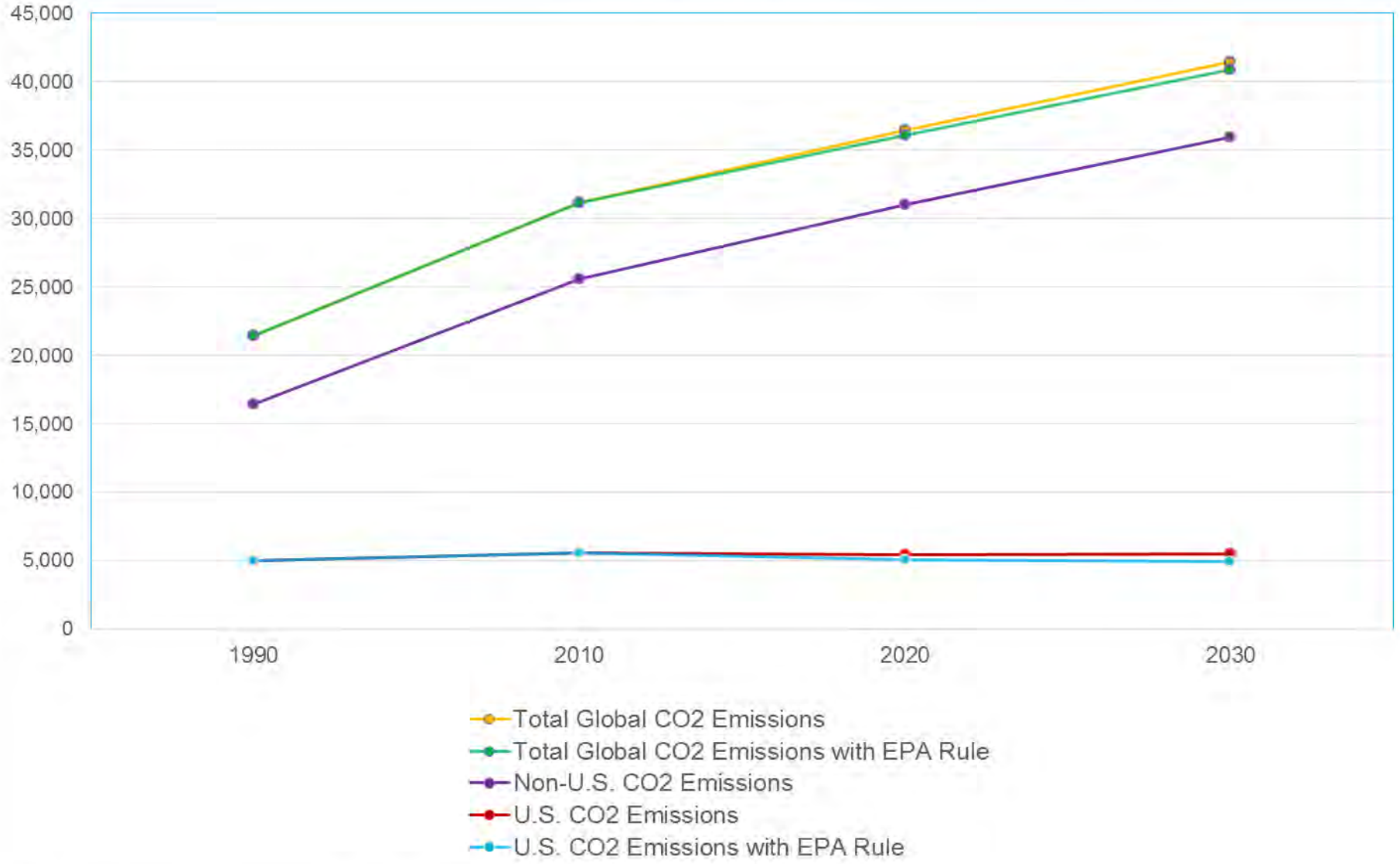
U.S. and Global Carbon Emissions Projections

(million metric tons)



Source: EPA Carbon Regulation Proposal, pg 547-548, and www.eia.gov/forecasts/ieo/table21.cfm

Charles D. McConnell

Charles D. McConnell is Executive Director of Rice University's Energy and Environment Initiative, a university-wide integration of science, engineering, economic analysis, policy and social sciences to address the diverse issues and challenges associated with energy security, affordability and environmental sustainability. The effort is designed to partner with industry and external stakeholders and position Rice as an impartial broker that combines technology and policy to create a sustainable energy platform for excellence in resource utilization and environmental stewardship.

A 35-year veteran of the energy industry, McConnell joined Rice in August 2013 after serving two years as the Assistant Secretary of Energy at the U.S. Department of Energy.
At DOE, McConnell was responsible for the strategic policy leadership, budgets, project management, and research and development of the department's coal, oil and gas, and advanced technologies programs, as well as for the operations and management of the U.S. Strategic Petroleum Reserve and the National Energy Technologies Laboratories.

Prior to joining DOE, McConnell served as Vice President of Carbon Management at Battelle Energy Technology in Columbus, Ohio, where he was responsible for business and technology management, including leadership of the Midwest Regional Carbon Sequestration Partnership.

McConnell also spent 31 years with Praxair, Inc., providing business leadership and strategic planning to the global hydrogen business, refining and chemicals markets, enhanced oil recovery, carbon dioxide management and the full range of energy technology R&D activities.

McConnell has held a number of board positions including chairmanships of the Gasification Technologies Council and the Clean Carbon Technology Foundation of Texas. McConnell holds a bachelor's degree in chemical engineering from Carnegie-Mellon University (1977) and an MBA in finance from Cleveland State University (1984).

House Committee on Science, Space & Technology

Testimony on EPA Clean Power Plan

Dr. David W. Cash
Commissioner
Massachusetts Department of Environmental Protection

July 30, 2014
Washington, DC

Thank you Chair Lamar Smith, Ranking Member Eddie Bernice Johnson, and other members of the Science, Space, and Environment Committee for the opportunity to provide comments on EPA's proposed Clean Power Plan. My name is David Cash and I am the Commissioner of the Massachusetts Department of Environmental Protection. Prior to this position, I was a Commissioner of our state's public utilities commission for three years focusing on grid reliability and protection of ratepayers. In total, I have worked in state government for ten years, always at the nexus of energy, environment and economic development.

Let me start with a story of dramatic change:

8 years ago, there was 3MW of installed solar power – today there is over 500MW in Massachusetts.

8 years ago, there was 3MW of installed wind power – today there is over 100MW.

Today there are over 5,000 companies and over 80,000 people employed in the clean energy economy in our state, and for the last 4 years, clean energy job growth has been between 6% and 12% per year.

Today, Fortune 500 companies and mom & pop shops, residential customers and cities and towns are taking advantage of our energy efficiency programs and collectively saving billions of dollars. For a company, this may mean hiring new people or expanding R&D or marketing; for a town maybe new teachers or fire fighters can be hired; for families across the Commonwealth, they have money in their pockets that they are not spending on energy. Over the last several years we've invested over $1B for energy efficiency and expect a return of $3-4B.

The arc of this story is simple: wise environmental protection and robust economic development can, and should, go hand in hand. In fact, since

1990, our carbon emissions have declined by 40%, while our economy has grown by almost 70%. [See Graph 1 in the Appendix].

The Administration of Governor Deval Patrick has launched a clean energy revolution in our state, introducing forward-looking policies and wide-ranging regulatory reform and regional partnerships. One of his first actions in office was to bring all of the energy and environment agencies under one umbrella, and add a mandate to link environmental protection and economic development. We have approached EPA's 111(d) rule with exactly this comprehensive perspective, understanding how these regulations will impact the power sector, energy prices, emissions and economic development.

Our conclusion is that implementation of 111(d) will mirror what has happened in the last 8 years in Massachusetts and other states but on a national scale: the private sector will respond, sparking innovation, entrepreneurship, energy cost savings, job growth, customer choice and opening up global markets for U.S. products and services.

While Massachusetts and many other states have begun to see the opportunities of addressing climate change, following the Supreme Court's ruling in 2007 that upheld the requirement that EPA must regulate greenhouse gases, EPA has provided a national path forward to seize clean energy opportunities nation-wide.

Massachusetts welcomes the release of the Clean Power Plan, which seeks to reduce carbon dioxide (CO_2) emissions from power plants under section 111(d) of the Clean Air Act. This proposed rule is a very important step forward towards the development of an advanced energy infrastructure that delivers cleaner air, smarter energy use, and job growth.

EPA conducted an unprecedented amount of outreach to states and other key stakeholders during the development of this proposed rule, recognizing the need for flexibility and the diversity of initiatives and programs that states are currently pursuing.

One such successful program is the multi-state Regional Greenhouse Gas Initiative. RGGI is a regional market-based carbon emissions reduction program for the power sector. In the Clean Power Plan EPA recognizes

regional market- based programs as acceptable compliance mechanisms. This is critical because the evidence is in: the RGGI experience has demonstrated that we can cost-effectively realize environmental and economic goals while maintaining electricity grid reliability.

The RGGI states have experienced a 40 percent reduction in power sector carbon dioxide pollution since 2005 as our regional economy has grown by 7% (adjusted for inflation). Of course, these significant pollution reductions are due to a combination of factors including market forces, the greater supply of natural gas, and other state clean energy policies, but RGGI has clearly been a driver as well. Through 2013 the RGGI states have invested more than $950 million in RGGI proceeds in energy efficiency, clean and renewable energy, and other strategic energy programs. In Massachusetts, we have invested more than $240 million through last year, with approximately 90 percent of these investments directed toward energy efficiency projects. A recent independent analysis by the Analysis Group concluded that investments from the first RGGI control period are adding $1.6 billion net economic value to our region. In the RGGI region, these types of strategic investments by Massachusetts and the other RGGI states occurred while customer rates were dropping. Our original predictions, as

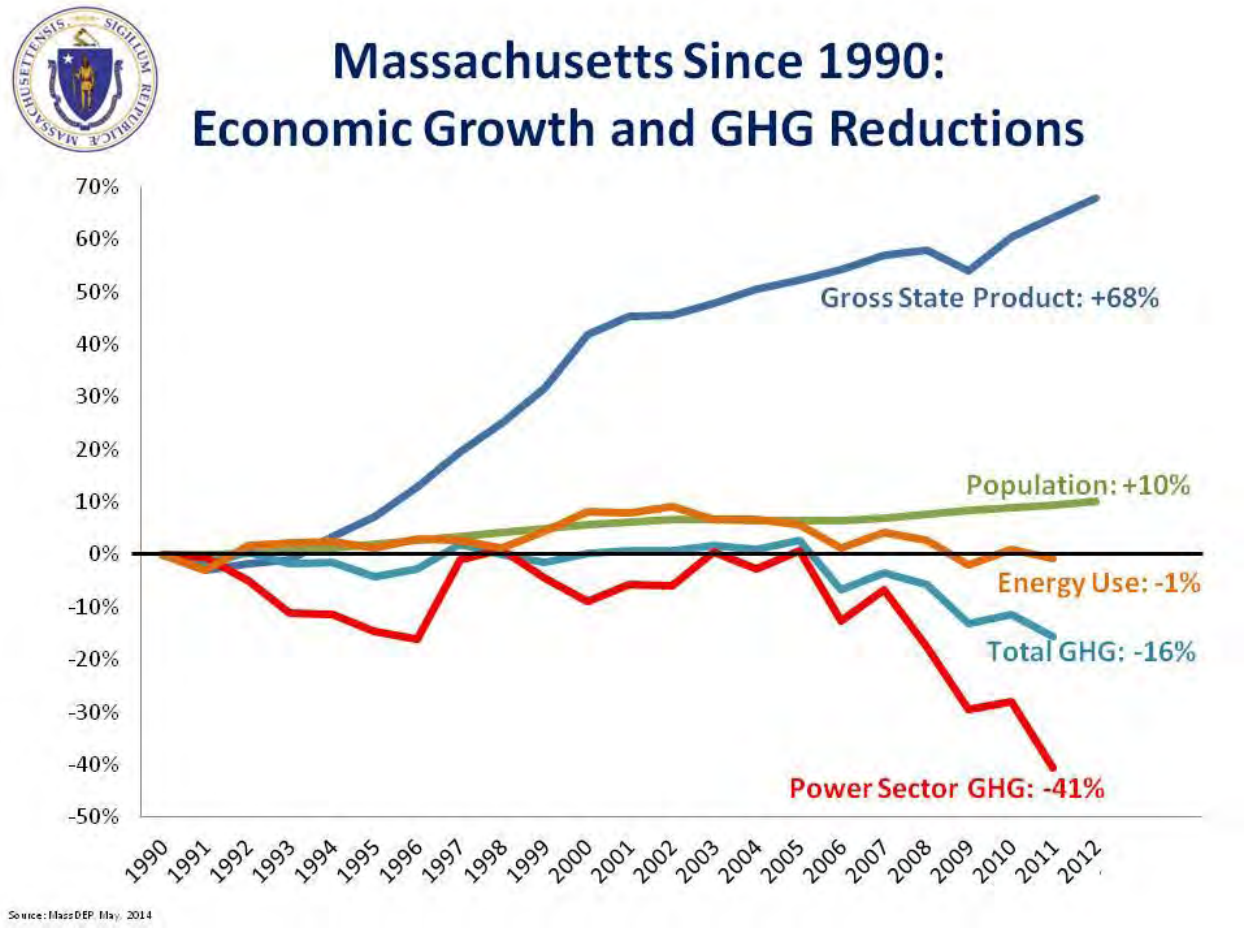
we began the developing RGGI, were that electricity rates would increase by 1-2% -- instead, region-wide they've declined by about 8%. All while emissions dropped by 40%, the economy grew by 7%, and grid reliability was enhanced through lower demand-related stress and solar power which produces electricity during peak demand periods.

We believe that ours and many other states' experience demonstrates that flexible carbon emissions reduction programs, coupled with other state policies, can prevent harmful pollution from entering the atmosphere, while also supporting a broad range of economic benefits, from lower energy bills, mitigation of price volatility and job growth. EPA should be commended for developing a proposed rule that recognizes the diversity amongst states and provides a flexible approach to compliance. By providing the states with this flexibility, Massachusetts believes the plan will not only aid in the effort to reduce carbon pollution, but will also help our nation develop an advanced energy infrastructure that delivers cleaner air, smarter energy use, an improved economy and new local jobs.

Thank you.

Appendix

Graph 1



David W. Cash was appointed on March 26, 2014 as Commissioner of the Massachusetts Department of Environmental Protection (MassDEP) by Governor Deval Patrick and his Secretary of Energy and Environmental Affairs, Richard K. Sullivan Jr.

Dr. Cash brings to MassDEP a wealth of experience in environmental, energy and regulatory sectors. He most recently held the position of Commissioner at the Massachusetts Department of Public Utilities (DPU) where he helped lead efforts to modernize the grid, expand the deployment of energy efficiency and renewable energy, and empower customers in their energy decisions.

Prior to his work at the DPU, Dr. Cash was the Undersecretary for Policy in the Massachusetts Executive Office of Energy and Environmental Affairs (EEA). In this role, Dr. Cash advised the EEA Secretary on an array of issues, including climate change, energy, land management, water management, oceans, wildlife and fisheries, air and water quality, environmental and energy dimensions of transportation, and waste management. He was one of the architects of clean energy legislation and implementation in the first term of the Patrick Administration, including the Green Communities Act, the Global Warming Solutions Act, the Green Jobs Act and the Clean Energy Biofuels Act. As part of this work, he led the Secretariat's effort in developing the Massachusetts Clean Energy and Climate Plan for 2020, which provides a roadmap of policies and programs that will lower energy costs, create clean energy jobs and reduce greenhouse gas emissions.

Prior to working for the Commonwealth, Dr. Cash was a research associate at the John F. Kennedy School of Government at Harvard University, and a Lecturer in Environmental Science and Public Policy. He also taught science in the Amherst, Massachusetts public schools from 1990-1993. He received a Ph.D. in Public Policy from the Kennedy School at Harvard in 2001, and a B.S. in biology from Yale University in 1987.

He lives in Newton with his wife Annie and their two high-school-age children, Sophie and Eliza.

Testimony before the House Committee on Science, Space, and Technology

EPA's Carbon Plan: Failure by Design

Wednesday, July 30, 2014

Testimony of Greg Sopkin
On Behalf of Wilkinson, Barker, Knauer LLP

Members of the Committee on Science, Space and Technology:

Thank you for the opportunity to offer testimony on the Existing Source Performance Standards being considered by the U. S. Environmental Protection Agency (EPA) under Section 111(d) of the Clean Air Act – it is an honor to be here from the great State of Colorado.

From 2003 to early 2007, I was Chairman of the Colorado Public Utilities Commission, which regulates investor-owned electric utilities. My testimony is focused on a white paper written by myself and my partner Ray Gifford, who also was a Chairman of the Colorado Public Utilities Commission. We wrote the paper because of our experience as state commissioners and working with the state environmental department and state legislature on regulatory matters. We identified several political, logistical, and practical problems that states will have implementing EPA's proposed rules. Some of the white paper's findings are:

The EPA's proposed Section 111(d) carbon reduction rule creates a carbon-driven energy resource planning process that is unlike any other Clean Air Act regulatory scheme. The proposed building blocks look strikingly like integrated resource planning (IRP), a function traditionally left to the states without federal oversight. It creates a novel 'Carbon IRP' for the states to implement.

Carbon IRPs, or their equivalent, will almost certainly require state legislation, regardless of whether a state is vertically-integrated or deregulated. States will need to devise institutional arrangements between the state PUC and state environmental regulator to implement carbon-driven resource planning.

The time constraints are severe and potentially insurmountable. States have little time, particularly given the need for state legislation, to make crucial and far-reaching decisions regarding EPA's proposed rule. These decision points include whether to act individually or on a multi-state basis, and determining what state agency or agencies should implement and oversee a Carbon IRP-like process.

The scope of the rule and implementation difficulties creates a serious risk of EPA takeover of state resource planning. State Implementation Plans (SIPs) deemed inadequate by EPA under its evaluation criteria will be superseded by an EPA-drafted Federal Implementation Plan (FIP). The breadth of the rule creates a plausible scenario whereby EPA, not the state utility regulator, is indirectly shaping and approving IRPs.

A carbon adder is likely a necessary implementation feature regardless of market structure. This applies in vertically-integrated states because a carbon adder must be included in any modeling. In deregulated states and/or wholesale markets, a carbon adder is needed to implement "environmental dispatch protocols."

All generators must participate in the Carbon IRP process, from investor-owned utilities to non-jurisdictional entities not traditionally subject to regulation. Rural cooperatives and municipal utilities will be subject to an entirely new level and scope of jurisdiction over their

resource planning activities. This will require new state legislation in many states and also increase compliance costs for these non-jurisdictional entities.

Central resource planning will return to restructured, competitive states. These states opted for competitive generation as a means to lower costs and achieve optimal resource mixes through competition instead of centralized resource planning by state utility commissions or similar entities.

Multi-state SIPs are accompanied by legal and practical peril, including the potential need for a Congressionally-approved interstate compact. Multi-state plans may be attractive in some regions, but the practical hurdles are significant. First, EPA SIP approval criteria requiring adequate enforcement mechanisms implicate the Compact Clause because enforcement can and should be on an interstate basis. Second, states should and will insist upon interstate enforcement mechanisms to address inevitable rivalries that develop given the interstate nature of the electric grid.

The remainder of my written testimony is the contents of the white paper. I encourage you to review it, and look forward to your questions – thank you.

State Implementation of CO_2 Rules

Institutional and Practical Issues with State and Multi-State Implementation and Enforcement

A White Paper

Release 1.0 – July 2014

Raymond L. Gifford
Gregory E. Sopkin
Matthew S. Larson

WILKINSON) BARKER) KNAUER) LLP

Executive Summary

The proposed rule implicates potentially impossible timelines. States have relatively little time to make crucial decisions regarding EPA's proposed rule, including whether to act individually or on a multi-state basis, which of four state plan pathways to take, what state agency(ies) should be responsible to implement a Carbon IRP-like process, how any ISOs or RTOs operating within the state will play a role, and what enforcement and corrective action measures are necessary to ensure compliance with the proposed rule.

'Carbon IRPs' will require new institutional arrangements and state legislation. States will need to devise institutional arrangements, which almost certainly will require new legislation, between the state PUC and state environmental regulator to implement carbon-driven resource planning.

All EGUs need to be in the room for a Carbon IRP process to be effective – including non-jurisdictional entities not traditionally subject to regulation. State plans will need to encompass all electric generation units, including those owned or operated by current non-state jurisdictional entities like rural cooperatives and municipal utilities. To the extent a state SIP relies on energy efficiency or demand response, all distribution utilities will need to be brought within carbon IRP planning as well.

Carbon-driven planning may result in a soft reintegration of restructured markets. Restructured wholesale markets will require integrated carbon planning across the market areas to ensure adequate capacity and reliability.

Multi-state SIPs are attractive based on market structure but are accompanied by legal and practical peril. Multi-state plans may be attractive within many regions, particularly when coincident with ISO or RTO footprints.

Multi-state SIPs may breed rivalrous scenarios, and EPA SIP approval criteria will require interstate enforcement mechanisms, which implicate the Compact Clause. Because state interests will be potentially rivalrous, multi-state SIPs will need an enforcement mechanism and may well require congressionally-approved interstate compacts to satisfy EPA requirements of enforceability.

FIPs may put state regulators in awkward positions, including by forcing ultra vires actions. State SIPs that are adjudged by EPA to be inadequate in terms of enforceable, quantifiable and verifiable reductions of EGU CO2 emissions equivalent to EPA's goals, and implementation of corrective actions, if necessary, will result in a FIP. A FIP creates legal issues of whether EPA has the authority to force state officials to enforce obligations they do not have authority to enforce under state law, and to engage in resource planning and direct system dispatch.

I. Overview

EPA's proposed rule to regulate carbon dioxide emissions ("Section 111(d)" or the "CO_2 Emission Guidelines") from electric generating units (EGUs), issued June 2, 2014, has triggered immediate analysis and commentary about the prudence and legality of EPA's approach under the Clean Air Act. This White Paper approaches the proposed rule from the perspective of states, and focuses in particular on the institutional and practical challenges that states face in implementing the proposed rule.[1]

To state our conclusion up front: There are manifold challenges and decisions for states, and between states, about how to implement the rule. In all conceivable scenarios, Section 111(d) implementation will require state legislation to erect new institutional arrangements for a state to consider a "Carbon Integrated Resource Plan" (Carbon IRP). In vertically-integrated states, non-jurisdictional generation and distribution operators like cooperatives and municipal utilities will need to be brought into the Carbon IRP process. Threshold institutional questions will also need to be answered. Will the Carbon IRP take place under the auspices of a public utilities commission or the state environmental regulator?[2] In states with restructured wholesale markets, there is a compelling rationale for states to enter into multi-state plans coincident with the wholesale market (RTO) territory. But even regionally, something resembling a Carbon IRP will be necessary, and adapting an "environmental dispatch" protocol will risk anointing winners and losers across states. Finally, the multi-state plan option implicates the need for interstate compacts, state legislation authorizing the compacts, and compliance with the Compact Clause of the U.S. Constitution.

Because it takes years for utilities and energy providers to plan and develop substantial changes to electricity generation portfolios - and additional time to obtain necessary state agency approval of these plans - EPA's Section 111(d) implementation timeline is very short indeed. States must submit their enforceable State Implementation Plans (SIPs) by June of 2016 (absent an EPA grant of a 1- or 2-year delay), and the SIPs must demonstrate considerable carbon reductions by 2020. Therefore, the issues that must be debated and decided among and between states *to determine what institutional structures must be in place to even begin deciding how the carbon reduction mandates will be reached* must occur over the next several months, not years. These political, logistical, and jurisdictional issues may well prove complex and intractable enough to undermine the foundation for EPA's Section 111(d) goals.

The issues that must be debated and decided among and between states to determine what institutional structures must be in place to even begin deciding how the carbon reduction mandates will be reached must occur over the next several months, not years.

States must formulate SIPs under the Section 111(d) implementing regulations. The CO_2 Emission Guidelines are accompanied by numerous legal and technical memoranda, including a memorandum that addresses state-level compliance "plan pathways." In its State Plan Considerations Technical Support Document, EPA proposes four "state plan pathways": (1) rate-based CO_2 emission limits; (2) mass-based CO_2 emission limits; (3) a state-driven portfolio approach; and (4) a utility-driven portfolio approach. A portfolio approach "would include emission limits for affected EGUs along with other enforceable end-use energy efficiency and renewable energy measures that avoid EGU CO_2 emissions."

EPA generally addresses the role of existing programs and processes in the CO_2 Emission Guidelines, including resource planning processes:

[1] For purposes of this analysis, we do not question EPA's legal authority to issue the rule, but rather what a state CO_2 regime will look like under Section 111(d) and the proposed implementing regulations.

[2] The U.S. Supreme Court recently denied a certiorari petition seeking review of a Missouri PSC decision denying Kansas City Power & Light cost recovery of FERC-approved transmission costs. Based on this, an investor-owned utility will likely insist on PUC involvement in Carbon IRP planning to ensure cost recovery of Carbon IRP planning decisions. *See State of Missouri ex. rel. KCP&L v. Missouri Public Service Commission*, 408 S.W. 3d 153 (Mo. App. 2013), *cert. denied*, 2014 WL 2921776 (June 30, 2014).

"States would be able to rely on and extend programs they may already have created to address the power sector. Those states committed to Integrated Resource Planning (IRP) would be able to establish their CO_2 reduction plans within that framework, while states with a more deregulated power sector system could develop CO_2 reduction plans within that specific framework." Here, then, is the crux of the institutional and practical questions states must confront with this rule.

This White Paper proceeds in five parts: overall considerations for SIP development, SIP implementation in vertically-integrated states, SIP implementation in restructured states and within RTOs, multi-state SIP considerations, and tentative conclusions.

At the outset, we want to emphasize that this "Release 1.0" of the White Paper is meant to be iterative, to provoke comment, correction and disputation. As we contemplate the practical implementation of the rule, we foresee the issues detailed below, but also emphasize that a rule this complex is difficult to get one's mind around. The issues we raise and conclusions we reach, therefore, should be regarded as tentative and partial. We welcome feedback because we envision iteratively focusing and improving this White Paper in future releases. For now, we see a daunting set of institutional challenges for the states that will profoundly affect the implementation and effectiveness of the rule, and its effect on the nation's electric system. These key issues and challenges include the need to:

As we contemplate the practical implementation of the rule, we foresee the issues detailed below, but also emphasize that a rule this complex is difficult to get one's mind around.

- Pass enabling legislation to implement the proposed rule at the state level.
- Construct institutional arrangements between the universe of regulators (public utility commissions (PUCs), environmental regulators, gubernatorial energy offices) in a state statutory and administrative context.
- Obtain and concentrate jurisdiction in the appropriate regulatory bodies over all affected entities, including current non-state jurisdictional entities like cooperatives and municipal utilities.
- Institute carbon-driven resource planning and dispatch in restructured markets to ensure adequate capacity and reliability.
- Structure enforceable and constitutional multi-state SIPs with interstate enforcement mechanisms, which may well require Congressionally-approved interstate compacts to satisfy EPA SIP approval criteria.

II. The Structure of the CO_2 Emission Guidelines and Key EPA Assumptions

a. Building Blocks and Performance Goals under the CO_2 Emission Guidelines

EPA's proposed CO_2 Emission Guidelines limit CO_2 emissions from EGUs in every state save Vermont and the District of Columbia. The proposed guidelines require each state to devise its own enforceable state implementation plan to meet the CO_2 performance goal, *i.e.*, emission limit, established by EPA for the state.[3]

[3] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 34,830 (June 18, 2014). In the proposed Table 1 to Subpart UUUU of 40 C.F.R. Part 60, EPA proposes interim and final goals for each state in pounds of CO_2 per net MWh. CO_2 Emission Guidelines at 643-645. The interim goals apply from 2020-2029, while the final goal applies in 2030. The interim goals as currently structured present a unique challenge for some utilities, as the 2020-2029 interim goal is "the simple average of the annual rates computed for each of the years from 2020 to 2029." CO_2 Emission Guidelines at 355. In addition, "[t]o be approvable, a state plan must demonstrate that the emission performance of affected EGUs will meet the interim emission performance level on average over the 2020-2029 period." CO_2 Emission Guidelines at 409. Part of the justification for the 2020-2029 interim goals is that "EPA recognizes the importance of ensuring that, during the proposed 10-year performance period (2020-2029) for the interim goal, a state is making steady progress toward achieving the required level of emission performance." CO_2 Emission Guidelines at 411. The need for *de facto* ongoing compliance on a trajectory could be difficult for utilities that may want to engage in long-term system planning such that it may miss interim goals in some years but would ultimately

A state is free to determine how it will achieve the EPA-set CO_2 performance goal, but EPA made certain general assumptions, applied to all states, to calculate each individual performance goal.

EPA calculated the CO_2 performance goal using four "building blocks": (1) assuming a six percent heat-rate efficiency improvement to each existing coal-fired EGU; (2) assuming a 70 percent capacity utilization rate for combined-cycle gas-fired EGUs; (3) calculating a renewable portfolio standard (RPS) based on the average RPS of states in the same region of the country, and assuming usage of nuclear power plants based on existing and expected nuclear units; and (4) assuming a one and one-half percent per year reduction in electric usage through demand-side management (DSM) measures.

b. Illustrative Application of the Building Blocks

EPA relied on the four building blocks in establishing the CO_2 performance goal for each state. For example, EPA calculated the CO_2 performance goal for Georgia as follows: (1) all coal-fired EGUs will improve their respective heat rate by six percent; (2) dispatch to gas combined cycle (CC) units can be increased to 70 percent; (3) the state can continue utilizing existing nuclear plants and Southern Company will complete construction of the Vogtle 3 and 4 nuclear units; (4) statewide renewable energy power generation can and will increase from three to ten percent; and (5) statewide DSM levels (demand reduction) will increase from 1.8 to 9.8 percent. The EPA's interim (2020-2029) mandate for Georgia is a CO_2 emission reduction from 1,534 to 891 pounds of CO_2 per megawatt hour (CO_2/MWh), which represents a reduction of 41 percent; and its final (by 2030) mandate is a reduction to 834 CO_2/MWh. This represents roughly a 46 percent reduction from 2012 baseline emissions.

achieve compliance on average through specific actions taken all at one time or over a one- to two-year period just prior to the implementation of the final goal in 2030. This "less steady" strategy would still comply with the interim goals on average and utilities may wish to preserve this option.

c. Must States Conform Resource Planning to Match the Building Blocks?

States are *not* required to overhaul the generation fleet to adopt assumptions used in the four building blocks; in other words, states do not necessarily have to reduce the heat rate of all coal-fired EGUs by six percent or increase gas CC dispatch to 70 percent. However, each state is ultimately responsible for achievement of its performance goal or, as discussed in more detail later in this paper, an aggregated multi-state performance goal. This is where EPA's "flexibility" talking point comes in, as states technically have flexibility to meet the performance goal as they see fit.[4] States do not have "flexibility" to modify the CO_2 performance goal set by EPA.

III. State Considerations in Formulating SIPs

> Each state is ultimately responsible for achievement of its performance goal or, as discussed in more detail later in this paper, an aggregated multi-state performance goal.

a. State Primacy and EPA's Proposed "Plan Pathways"

As referenced above, states have primacy and discretion in devising SIPs under the CO_2 Emission Guidelines.[5] For example, although the state-promulgated "emission standards" are to be "no less stringent than the corresponding emission guideline(s)" issued by EPA, states may make a case-by-case determination that a specific facility or class of facilities are subject to a less-stringent standard or longer compliance schedule due to: (1) cost of control; (2) a physical limitation of installing necessary control equipment; and (3) other factors making the less-stringent standard more reasonable.[6] State-level

[4] *See, e.g.*, EPA Administrator Gina McCarthy, *Remarks Announcing Clean Power Plan, As Prepared*, (June 2, 2014) *available at* http://yosemite.epa.gov/opa/admpress.nsf/8d49f7ad4bbcf4ef852573590040b7f6/c45baade030b640785257ceb003f3ac3!OpenDocument (mentioning the word "flexibility" eight times in speech announcing the CO_2 Emission Guidelines and stating "[t]his plan is all about flexibility. That's what makes it ambitious, but achievable. That's how we can keep our energy affordable and reliable. The glue that holds this plan together, and the key to making it work, is that each state's goal is tailored to its own circumstances, and states have the flexibility to reach their goal in whatever way works best for them.")

[5] *See generally* 40 C.F.R. Part 60, Subpart B.

[6] 40 C.F.R. § 60.24(f).

compliance "plan pathways" are discussed in a accompanying Technical Support Document (TSD) to the rule.[7] The TSD details the states' options:

- Rate-based CO_2 emission limits: "Rate-based emission limits would apply a lb CO_2/MWh emission limit to affected EGUs. Depending on a state's approach, compliance flexibility could be provided through different mechanisms, such as averaging among affected sources, or the use of tradable credits for avoided CO_2 emissions resulting from end-use energy efficiency and renewable energy measures …."[8]

- Mass-based CO_2 emission limits: "Mass-based emission limits would apply either an individual limit on CO_2 tons emitted from an affected EGU or establish a finite CO_2 emissions budget for a group of affected EGUs. The latter approach is typically implemented through a tradable allowance system. With mass-based emission limits, end-use energy efficiency measures that avoid EGU CO_2 emissions could be a major component of a state's overall strategy for cost-effectively reducing EGU CO_2 emissions, but would be complementary to the enforceable state plan (i.e., not included as enforceable measures in a state plan). These actions could be used to help a state cost-effectively achieve the CO_2 emissions limits, or to achieve other policy goals, but CO_2 emissions performance would be assured through the enforceable limit on mass emissions from affected EGUs."[9]

- Portfolio approach: "The second basic state plan approach uses a portfolio of actions, in which a state plan includes multiple programs and measures that are designed to achieve either a rate-based or mass-based emissions performance goal for affected EGUs …. [A] portfolio approach is distinguished from an emission limit approach by the fact that achievement of the full level of required emission performance for affected EGUs specified in the plan is not ensured through the application of direct emission limits that apply to affected EGUs …. [A] portfolio approach implemented in a restructured state with retail competition will likely look quite different from one implemented in a state with vertically integrated, regulated electric utilities. This includes the process for developing the portfolio approach, the mechanisms for implementing it, the responsible parties, and the regulatory and legal relationships among parties and state regulators."[10]

  - State-driven portfolio approach: "A state-driven portfolio approach – rather than a utility-driven approach – is more likely to be adopted in a state with a restructured electricity sector …. Under a state-driven portfolio approach a mix of entities might have enforceable obligations under a state plan. This includes owners and operators of affected EGUs subject to direct emission limits, as well as electric distribution utilities, private or public third-party entities, and state agencies or authorities that administer end-use energy efficiency and renewable energy deployment programs or are subject to portfolio requirements."[11]

  - Utility-driven portfolio approach: "Under a utility-driven portfolio approach, a vertically integrated utility would develop and implement a portfolio of measures designed to meet the rate-based or mass-based emission performance level for its affected EGUs specified in the state plan. This plan would likely be developed and approved through an IRP-like process overseen by the state public utility commission. If there is more than one rate-regulated electric utility in the state, the state might apportion the state emission performance level for affected EGUs among utilities …. Under a utility-driven portfolio approach, the entire suite of obligations under the plan would be enforceable against the utility company, which would also be an owner and operator of affected EGUs …. A similar approach could be taken by municipally owned utilities or utility cooperatives, which often

[7] *See* EPA Office of Air and Radiation, *State Plan Considerations – Technical Support Document for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, Docket ID No. EPA-HQ-OAR-2013-0602 (June 2014), *available at* http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-state-plan-considerations.pdf.
[8] *Id.* at 7.
[9] *Id.* at 8.
[10] *Id.* at 8-9.
[11] *Id.* at 9-10.

> also engage in an IRP process. However, state public utility commissions often do not regulate these utilities. As a result, implementation of a portfolio approach by these entities would introduce practical enforceability considerations under a state plan."[12]

According to EPA, "[s]tates would be able to rely on and extend programs they may already have created to address the power sector. Those states committed to Integrated Resource Planning would be able to establish their CO_2 reduction plans within that framework, while states with a more deregulated power sector system could develop CO_2 reduction plans within that specific framework."[13] However, this generic statement belies the myriad complexities associated with building a CO_2-driven regulatory regime into preexisting, state- or region-level resource planning architecture.

b. Enforcement as a Prerequisite for EPA Approval

A SIP must be enforceable by a state or group of states as a prerequisite for EPA acceptance. Consistent with the history of the Clean Air Act and the SIP-driven compliance approach, EPA makes clear in the CO_2 Emission Guidelines that the ability to enforce emission standards is a key, if not the most important, element the agency will consider in evaluating SIPs. Enforcement is paramount under single state or multi-state SIPs, and applies across the board to any and all actions relied upon to achieve compliance with emission standards. EPA provides that:

> A state plan must include enforceable CO_2 emission limits that apply to affected EGUs. In doing so, a state plan may take a portfolio approach, which could include enforceable CO_2 emission limits that apply to affected EGUs as well as other enforceable measures, such as RE and demand-side EE measures, that avoid EGU CO_2 emissions and are implemented by the state or by another entity.
>
> …
>
> The EPA is proposing to evaluate and approve state plans based on four general criteria: 1) enforceable measures that reduce EGU CO_2 emissions; 2) projected achievement of emission performance equivalent to the goals established by the EPA, on a timeline equivalent to that in the emission guidelines; 3) quantifiable and verifiable emission reductions; and 4) a process for biennial reporting on plan implementation, progress toward achieving CO_2 goals, and implementation of corrective actions, if necessary.[14]

In order for a state to devise an acceptable SIP, the necessary regulatory structures must be in place to enforce CO_2 reductions of EGUs. For a substantial percentage of EGUs across the U.S., these structures do not exist.

In vertically-integrated states, investor-owned utilities are regulated by state PUCs, generally through integrated resource planning processes. Municipal and rural electric cooperative utilities, by contrast, are often "self-regulating" and autonomously determine their resource portfolios, with exceptions.[15] In states that are all- or partially-restructured, independent system operators (ISOs) or RTOs help govern the electric system. However, generation in ISOs and RTOs is not subject to traditional IRP processes and can be owned by merchant generators or utilities.

c. The Need for New State-Level Regulatory Architecture

In order for a state to devise an acceptable SIP, the necessary regulatory structures must be in place to enforce CO_2 reductions of EGUs. For a substantial percentage of EGUs across the U.S., these structures do not exist. With the possible exception of California, no states have expressly delegated regulatory authority to implement and oversee carbon-based resource planning, including enforcement and corrective action

[12] *Id.* at 11-12.
[13] CO_2 Emission Guidelines at 22.
[14] CO_2 Emission Guidelines at 43-44, 46.
[15] While many states exempt municipal utilities and cooperatives from PUC administrative regulation, others do not. For instance, Arkansas and Florida regulate cooperative utilities to a greater extent; other states have exempted their municipal and cooperative utilities from administrative regulation. It will be a state-by-state determination of the institutions which are authorized to regulate a given EGU or distribution utility.

authority. Therefore, states will likely need to pass legislation to enforce carbon reductions set forth in a SIP. This is not to say that all states will necessarily need legislation, but in particular to take advantage of the portfolio approaches detailed by EPA, a new institutional arrangement between PUCs and state environmental regulators will be necessary. By the same token, even for states adopting a source-based approach, the environmental regulator will likely need to coordinate with the PUCs to fully appreciate cost and reliability concerns.

Enacting legislation to create the new institutional arrangements may be difficult in vertically-integrated states. Generation & Transmission (G&T) organizations, rural electric cooperatives, and municipalities have traditionally been opposed to ceding generation planning to an outside regulatory agency (assuming, *arguendo*, that the outside agency has jurisdiction over these entities in the first instance). Municipal and public power utilities have always self-determined their resource plans. While G&Ts are required in some states to obtain approval to construct a new generation plant, they have not been required to obtain approval of their IRPs. In addition, the rivalrous nature of different utilities' interests threatens 'who's ox is being gored' rivalries, where the costs and pains will be difficult to apportion among utilities with dramatically different carbon profiles.

d. What if a State Declines to Participate?

A final option states might consider with carbon rule implementation would involve the affirmative refusal to participate in devising a SIP. This could occur through the failure of legislation creating the institutional administrative structure described earlier. Or, it could be conceived as an affirmative policy stance of the state to not submit a SIP.[16]

While a state may chart such a course, the outcome would be EPA implementing its own Federal Implementation Plan (FIP) and enforcement authority under the Clean Air Act. The FIP would, in essence, amount to EPA taking over resource planning in the given state and subsuming enforcement powers for carbon reductions to itself. Furthermore, EPA would take jurisdiction over where carbon reductions come from and what makes up an adequate portfolio of reductions — the 'right' combination of heat rate improvements, increased CT dispatch, and renewable and demand response. In short, a state would be handing over its Section 111(d) prerogatives to the federal agency, which has little to no experience with issues such as reliability, cost analysis or demand response verification. Thus, while defiance of EPA is certainly an option, the potential downside of such an approach could be precipitous for states electing such a path.[17]

IV. CO_2 SIP Implementation in Vertically Integrated States

a. General Resource Planning Issues

In vertically-integrated states, modern IRPs look at issues that go well beyond a utility's self-build generation plans. Investor-owned utilities present estimates to state public utility commissions for future load, customer growth, fuel (gas and coal) prices, cost of renewables, resource margins, and other data to support proposed IRPs. In addition to any self-build proposals, these plans involve power purchases from independent power producers (IPPs), renewable energy portfolios, and DSM. Typically, state policy goals or mandates such as renewable energy penetration and DSM are overlaid onto a lowest cost portfolio approach.

While G&Ts, rural electric cooperatives, and municipalities have been subject to environmental regulation at the federal and state levels, including air quality regulation under the Clean Air Act, EPA's proposed CO_2 Emission Guidelines go beyond pollution control measures directed at EGUs. Perhaps recognizing that inside-the-fence, *i.e.*, implemented at the source, measures are insufficient to meet EPA's 30 percent carbon reduction goal by 2030, only one building block assumption - average heat rate improvement of six percent for coal-fired EGUs - is source-focused. Building blocks 2, 3 and 4 of the CO_2 Emission Guidelines assume that utilities can meet

[16] There are cooperative federalism schemes in the utility sphere where states have opted-out. Alaska and Hawaii, for instance, have not passed statutes to participate in the federal PHMSA program. Virginia, quite notably, refused to participate in implementation of the Telecommunications Act of 1996.

[17] EPA enforcement is not limited to imposition of a FIP. Under certain circumstances, EPA may (1) prohibit the approval by the U.S. Secretary of Transportation of state highway funding for the state or (2) increase the non-attainment area New Source Review emission offset ratio to at least two to one. 42 U.S.C. §§ 7509(a)(3), 7509(b).

certain outside-the-fence metrics. Although the proposed rule does not require states and utilities to actually implement these metrics, they are the root of each CO_2 performance goal.

b. State PUC or Environmental Regulator as Lead Agency

Portfolio-based metrics, *i.e.*, non-source-based emission limits, strongly resemble the resource planning function traditionally performed by state utility commissions: reliance on existing and under-construction natural gas CC units to up to 70 percent capacity factor; expansion of renewable generation; reliance on existing and under-construction nuclear facilities; and increase of demand-side energy efficiency to one and one-half percent annually. A state may choose to enforce the measures utilized by the EPA to determine carbon reduction amounts for the state. In the alternative, if these prove impracticable or unworkable, a state may order a variant of these measures or simply mandate closure of carbon-emitting EGUs.

Portfolio-based metrics, *i.e.*, non-source-based emission limits, strongly resemble the resource planning function traditionally performed by state utility commissions.

In any case, entities that own or dispatch EGUs - and that have not been subject to state authority - will inevitably find themselves under the umbrella of state CO_2 regulations by a designated agency. That agency could be the state PUC, or the state environmental agency, or some new hybrid of the two agencies.

With a portfolio compliance approach in particular, the state PUC makes the most sense based on its experience and expertise with Building Blocks 2, 3 and 4.[18] State environmental agencies may be given a consulting role similar to the process employed in the Clean Air-Clean Jobs Act in Colorado,[19] but the state PUC is much more likely to adjudicate the resource plan. In the alternative, with a pure source-based compliance plan, the environmental agency might be adequately suited to take the lead. However, the PUC would still need to be involved because the state will also have cost and system reliability concerns. In either case, states will be wrestling to create a new hybrid regulatory process that likely involves both the PUC and the environmental regulator.[20]

The state agency devising the Carbon IRP also will have to take on the role as CO_2 SIP enforcer. Normally, utilities present a resource plan to the state commission, and the commission may approve, deny or modify the plan. A utility gains a presumption of prudency by following the measures in the approved plan. A state agency enforcing the EPA Section 111(d) rule must be able to enforce "measures that reduce EGU CO_2 emissions" and implement "corrective actions, if necessary."[21] This changes the consequences of a 'missed' IRP decision: the state must be able to enforce the Carbon IRP, presumably by dictating and sanctioning all relevant EGUs or other participants in the carbon reduction portfolio under the state SIP. The corrective actions available to the state Carbon IRP-enforcer include those sanctions available under Section 113(a)-(f) of the Clean Air Act, including without limitation the issuance of administrative penalties of up to $37,500 per day[22] and instituting criminal proceedings against "[a]ny person who knowingly" violates relevant provisions of a SIP.[23] The "any person" language in the Clean Air Act can and does allow for enforcement against private parties.

[18] It could be argued that state environmental agencies should be given the authority to develop and impose carbon reductions on EGUs, as these agencies have traditionally been involved with implementation of EPA pollution reduction measures. However, given the IRP-like "building block" approach of EPA in its proposed rule, it appears more appropriate for state PUCs to have primary authority. Nevertheless, one of the political disputes that may develop is over which agency should be tasked with this important role.

[19] *See* Colorado PUC Docket No. 10M-245E; Colorado House Bill 10-1365.

[20] Tennessee and Nebraska, because they are exclusively served through public power, might either consider implementing the rule exclusively through the environmental regulator – a tall order if they are going to pursue a portfolio approach, especially involving the audit and verification burdens associated with DR. Alternatively, they could decide to confer the Nebraska PSC and the Tennessee Regulatory Authority (TRA), respectively, with new jurisdiction over the carbon IRP that they do not currently possess.

[21] CO_2 Emission Guidelines at 46.

[22] 42 U.S.C. § 7413(d). In late 2013, EPA made the default penalty up to $37,500 per day of violation. 78 Fed. Reg. 66,643 (Nov. 6, 2013).

[23] 42 U.S.C. § 7413(c).

c. Timing Issues with State Enabling Legislation

The need for state legislation in vertically integrated states creates a significant timing issue. The proposed CO_2 Emission Guidelines will not be finalized until June 2015 under EPA's current timeline, and (absent an EPA-granted extension of time) states must submit SIPs by June 2016. Most state legislative sessions are conducted in the early months of the calendar year, *e.g.*, January to April or May. In addition, some state legislatures do not meet every year. For example, the state legislative sessions of Montana, Nevada, North Dakota and Texas occur biennially, in odd-numbered years.

This time crunch could become even more severe considering that many utilities, *e.g.*, non-jurisdictional municipal utilities and cooperatives, have never filed an integrated resource plan before, and multiple utilities would be making the filing at the same time.

Many states may be reluctant to pass legislation granting CO_2 reduction enforcement authority to state PUCs or other agencies until the EPA rule is final. EPA has made clear that it is engaged in a "listening tour" to receive comments from the states and other stakeholders, and that it may change the proposed rule based on this feedback. Indeed, EPA's proposed rule poses numerous questions about whether certain provisions should be imposed, introducing a degree of uncertainty regarding the potential scope of the final rule.

Those states that wait until 2016 to pass legislation may find themselves in an unenviable position due to impossible time constraints (notably, Montana, Nevada, North Dakota and Texas will not have a 2016 legislative session unless a special session is called). Resource planning cases require substantial planning and development by utilities before they are filed. These cases are quasi-adjudicatory, involving interventions from various stakeholders, testimony, discovery, motions practice, briefing, and evidentiary hearings. This time crunch could become even more severe considering that many utilities, *e.g.*, non-jurisdictional municipal utilities and cooperatives, have never filed an integrated resource plan before, and multiple utilities would be making the filing at the same time.[24]

The proposed CO_2 Emission Guidelines do include a one- or two-year extension provision that involves a two-phased SIP submittal process for state plans. If a state needs additional time to submit a complete plan, then it must tender an initial plan by June 30, 2016 that explains why the state needs more time and includes commitments to ensure that the state will submit a complete plan by June 30, 2017 or 2018, as appropriate.[25] To be approvable, the initial plan must include specific components, including a description of the plan approach, initial quantification of the level of emission performance that will be achieved in the plan, a commitment to maintain existing measures that limit CO_2 emissions, an explanation of the path to completion, and a summary of the state's response to any significant public comment on the approvability of the initial plan. If the initial plan is approved, the state would have until June 30, 2017 to submit a complete plan if the geographic scope of the plan is limited to that state. If the state develops a plan using multi-state approach, it would have until June 30, 2018 to submit a complete plan.

[24] Any planning process necessarily involves the input of appropriate regulatory bodies at the state level as well as affected entities. This may require PUCs to open investigatory/miscellaneous dockets or their functional equivalent under state law to allow utilities and other affected entities to submit relevant data and preserve confidentiality protections, where necessary. Some utilities are already receiving informal "discovery requests" regarding CO_2 emissions data and other relevant information. To allow utilities to protect this information, PUCs should open investigatory/ miscellaneous dockets or a functional equivalent such that there is a level of administrative law formality to allow affected entities to protect confidential and proprietary information. In addition, affected entities, specifically jurisdictional and non-jurisdictional utilities as well as fuel supply, should be engaging with state regulators and pushing to begin the exploration of the structure of a Carbon IRP or similar process what legislative changes may be required.

[25] *See, e.g.*, 40 C.F.R. §§ 60.5755, 5760 (as proposed in the CO_2 Emission Guidelines at 618).

However, it is unclear whether the EPA would allow a one- or two-year delay for a state that has not both passed legislation effective before June 30, 2016 *and* have a state agency-determined initial plan approach with "quantification of the level of emission performance that will be achieved in the plan."[26] The language of the CO_2 Emission Guidelines appears to require a demonstration that the plan will meet the required carbon reductions and be enforceable, suggesting that the legislation and state agency determination must be complete for any initial plan and related extension of time to submit a complete plan to be approved.

V. CO_2 SIP Implementation in Restructured States

a. Background on Restructured States and References in the CO_2 Emission Guidelines

In restructured states, the wholesale market clears generation needs, and utilities either have spun-off their generation assets, or hold them in a separate subsidiary. Electric distribution utilities purchase electricity from competitive wholesale markets. There is no IRP process in these states, and therefore EPA takes the position that "[a] state-driven portfolio approach" is likely most suitable for restructured states. EPA envisions a regime where a wide variety of entities, ranging from generation owners to non-profit organizations, would be subject to an overarching regulatory scheme to achieve standards and CO_2 emission reductions set forth in the SIP. EPA provides an example for restructured states:

> One likely state plan scenario involves inclusion of enforceable obligations for state-regulated entities other than affected EGUs. An example of a state-regulated entity that is not an owner or operator of affected EGUs may be an electric distribution utility. These entities are typically regulated by a state public utility commission. An example of an enforceable state plan measure that might apply to an electric distribution utility is a compliance obligation under a state end-use energy efficiency resource standard (EERS) or renewable portfolio standard (RPS), or implementation of incentive programs for the deployment of end-use energy efficiency and renewable energy technologies.[27]

b. Practical Issues in Restructured States

This creates numerous practical issues. Perhaps the paramount issue is that the regime outlined by EPA may ultimately result in a degree of soft reintegration of the utility function in restructured states. These states opted for competitive generation as a means to lower costs and achieve optimal resource mixes through competition instead of centralized resource planning by state utility commissions or similar entities. An equivalent Carbon IRP process necessarily reintroduces a central planning aspect to generation because allowable facilities must now be approved through the regulatory process and portfolios must be balanced by each state.

Perhaps the paramount issue is that the regime outlined by EPA may ultimately result in a degree of soft reintegration of the utility function in restructured states.

There are other practical considerations in restructured states. First, as with vertically integrated states, regulation of such a diverse group of entities will almost certainly require new enabling legislation. This introduces all of the same timing considerations discussed above. It also creates overlapping regulator issues between state utility commissions and environmental regulators, as regulation of certain activities, *e.g.*, non-profits administering or implementing energy efficiency programs, may be done by one agency while merchant generators may be regulated separately by a another agency. In turn, this creates implementation difficulties for any SIP approved by EPA.

Finally, submission of a SIP premised upon a new regulatory scheme raises general compliance issues. SIPs must be enforceable by the states to be approved by EPA. If a state submits a SIP which it cannot enforce because it cannot convey legal authority and get itself organized, it opens itself up to a FIP and numerous other potential sanctions by EPA. The FIP

[26] CO_2 Emission Guidelines, at 48.

[27] *State Plan Considerations* at 14.

would create a host of legal issues, from potentially forcing state officials to enforce obligations they do not have authority to enforce under state law to EPA indirectly engaging in resource planning and directing system dispatch. Another concern in restructured states is that states would pass new legislation implementing a new regulatory paradigm to allow for enforcement against the relevant entities and actors. Once this avenue is created under state law, it creates an opportunity for EPA to come in and regulate these entities indirectly through the FIP under the new state laws. Indeed, the creation of new regulatory paradigms creates a similar issue in vertically-integrated states as well.

Another concern in restructured states is that states would pass new legislation implementing a new regulatory paradigm to allow for enforcement against the relevant entities and actors. Once this avenue is created under state law, it creates an opportunity for EPA to come in.

Restructured markets thus present a challenge to the state-by-state Carbon IRP model that seems to be contemplated by the EPA rule. To be sure, the most sensible course would appear to be for restructured states to engage in multi-state plans coincident with RTO boundaries. This creates its own problems, particularly in states like Missouri, Illinois, Indiana and Arkansas, where two separate RTOs operate within the state. Nevertheless, we turn to the institutional issues associated with multi-state plans below.

c. Environmental Dispatch as a Compliance Strategy

Environmental dispatch protocols have been referenced in the days following the issuance of the CO_2 Emission Guidelines as potential multi-state compliance strategies in states that participate in restructured wholesale markets. With environmental dispatch, speaking strictly in the CO_2 context, the RTO seeks to identify an optimal generation schedule that achieves appropriate power balance, satisfies unit operating limits, and minimizes both fuel cost *and* CO_2 emissions. Based upon our rudimentary understanding of environmental dispatch protocols, the use of a carbon imputation in bid pricing represents a clear way to implement an environmental dispatch strategy. However, the CO_2 Emission Guidelines do not appear to provide for such a compliance strategy in a SIP. In addition, it is unclear how a SIP, or a multi-state SIP for that matter, would be built around a dispatch protocol for an RTO. This would be novel to say the least, and also raises questions of enforcement, specifically whether the member states could enforce the dispatch protocols through the SIP and how corrective action might work in this context. Both enforcement and corrective action are mandated within EPA's SIP approval criteria.[28] While significant questions remain, EPA seeks comment on the roles of RTOs in implementing SIPs: "The ISO/RTO Council, an organization of electric grid operators, has suggested that ISOs and RTOs could play a facilitative role in developing and implementing region-wide, multi-state plans, or coordinated individual state plans. Existing ISOs and RTOs could provide a structure for achieving efficiencies by coordinating the state plan approaches applied throughout a grid region."[29] Needless to say, the roles of RTOs and environmental dispatch in effectuating CO_2 Emission Guidelines are an open question in this rulemaking.

It is unclear how a SIP, or a multi-state SIP for that matter, would be built around a dispatch protocol for an RTO. This also raises questions of enforcement.

The SIP modification process, as proposed, raises questions how a SIP premised on an "environmental dispatch" strategy would be modified if it were not achieving the intended results. When implementing an approved SIP, a state might find the need to update or alter one or more of the enforceable measures in the state plan, or even replace certain existing measures with new measures. The CO_2 Emission Guidelines provide:

[28] CO_2 Emission Guidelines at 46.
[29] *Id.* at 430.

> The notion that states can jointly submit a SIP, and in turn rely on one another to effectuate compliance with an emission standard, is novel under the Clean Air Act.

> EPA proposes that the state may revise its state plan provided that the revision does not result in reducing the required emission performance for affected EGUs specified in the original approved plan. In other words, no "backsliding" on overall plan emission performance through a plan modification would be allowed.
>
> If the state wishes to revise enforceable measures in its approved state plan, EPA proposes that the state must submit the revised enforceable measures to the EPA and demonstrate that the revised set of enforceable measures in the modified plan will result in emission performance at affected EGUs that is equivalent to or better than the level of emission performance required by the original state plan.[30]

Accordingly, a SIP premised on environmental dispatch of generation would appear to require EPA approval before any material changes to dispatch protocol were made. EPA thus would become the approval authority for generation dispatch protocols under a mass emissions plan.[31]

VI. Multi-State State SIP Considerations

a. EPA's Proposed Multi-State SIPs

In the proposed CO_2 Emission Guidelines, EPA proposes a multi-state SIP compliance avenue, *i.e.*, two or more states can jointly submit a SIP with aggregated emission goals. EPA has implemented past air quality programs, such as the NO_x Budget Trading Program, on a regional basis; however, the notion that states can jointly submit a SIP, and in turn rely on one another to effectuate compliance with an emission standard, is novel under the Clean Air Act.[32] EPA describes multi-state SIPs as follows:

> For states wishing to participate in a multi-state plan, the EPA is proposing that only one multi-state plan would be submitted on behalf of all participating states. The joint submittal would be signed by authorized officials for each of the states participating in the multi-state plan and would have the same legal effect as an individual submittal for each participating state. The joint submittal would adequately address plan components that apply jointly for all participating states and for each individual state in the multi-state plan, including necessary state legal authority to implement the plan, such as state regulations and statutes. Because the multi-state plan functions as a single plan, each of the required plan components … would be designed and implemented by the participating states on a multi-state basis.[33]

> States retain primacy under Section 111(d) to develop legally enforceable emission standards and compliance schedules, but states submitting a multi-state SIP would have a multi-state rather than single state CO_2 performance goal and would demonstrate emission performance "in aggregate with partner states."

States retain primacy under Section 111(d) to develop legally enforceable emission standards and compliance schedules, but states submitting a multi-state SIP would have a multi-state rather than single state CO_2 performance goal and would demonstrate emission performance "in

[30] *Id.* at 468-69.

[31] "[A]ny person," including PUCs, would also likely be subject to novel Clean Air Act citizen suits during the pendency of its request to modify dispatch protocols. 42 U.S.C. § 7604. Certain special interest groups bring these suits with regularity.

[32] *See, e.g.*, EPA, *Guidance on Infrastructure State Implementation Plan (SIP) Elements under Clean Air Act Sections 110(a)(1) and 110(a)(2)*, at 1 (Sept. 13, 2013) (providing in part that "Under Clean Air Act (CAA) sections 110(a)(1) and 110(a)(2), *each state is required to submit a state implementation plan (SIP)* that provides for the implementation, maintenance, and enforcement of each primary or secondary national ambient air quality standard (NAAQS). Moreover, section 110(a)(1) and section 110(a)(2) require each state to make this new SIP submission within 3 years after promulgation of a new or revised NAAQS.") (emphasis added).

[33] CO_2 Emission Guidelines at 434.

aggregate with partner states."[34] This aggregation occurs notwithstanding whether states pursue a rate-based or mass-based compliance approach:

> [S]tates taking a rate-based approach would demonstrate that all affected EGUs subject to the multi-state plan achieve a weighted average CO_2 emission rate that is consistent, in aggregate, with an aggregation of the state-specific rate-based CO_2 emission performance goals established in the emission guidelines that apply to each of the participating states. If states were taking a mass-based approach, participating states would demonstrate that all affected EGUs subject to the multi-state plan emit a total tonnage of CO_2 emissions consistent with a translated multi-state mass-based goal. This multi-state mass-based goal would be based on translation of an aggregation of the state-specific rate-based CO_2 emission performance goals established in the emission guidelines that apply to each of the participating states.[35]

Accordingly, regardless of the emission calculation approach chosen, multi-state SIPs are submitted jointly and based upon aggregated performance goals. States would "rise and fall" together based on collective performance and compliance with the multi-state SIP.

EPA also may include state-specific requirements for multi-state plans. The proposed rule asks whether states submitting multi-state plans should also be required to provide individual submittals that: (1) provide state-specific elements of the multi-state plan; and (2) address all elements of the multi-state plan.

b. RGGI as the Prototypical Multi-State SIP

The CO_2 Emission Guidelines reference the Regional Greenhouse Gas Initiative (RGGI) on numerous occasions as an example of a regime that addresses CO_2 emissions on a multi-state, regional basis, and EPA cites RGGI as an example of a group of states that may submit a multi-state SIP.[36] Given EPA's understandable emphasis on enforceability, however, it is questionable whether RGGI as currently structured could submit a SIP that would satisfy EPA's four general criteria.

RGGI is a cap-and-trade system for CO_2 emissions from fossil-fuel fired EGUs with 25 MW or greater generating capacity. The following nine states currently participate: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. This regional CO_2 emissions reduction strategy began in 2005, when seven states signed a Memorandum of Understanding (MOU) committing the state to the "CO_2 Budget Trading Program." The MOU set an initial regional emission cap of 121.2 million short tons; this regional base annual CO_2 emissions budget was then apportioned to each state individually based on its specific emissions history. EPA explains that:

> The program works as a coordinated regional whole through a shared emission and allowance tracking system and allowance auction process, but is implemented in accordance with materially consistent, stand-alone state regulations and individual statutory authority. These regulations recognize CO_2 allowances issued by other participating states for use by affected EGUs when complying with each state's emission limitation, but contain all the necessary components to administer the program requirements on an individual state basis.[37]

As a result, each state develops its own individual regulatory and/or statutory structure based on an agreed-upon "Model Rule" that provides a framework for the development of individual state proposals.

[34] *Id.* at 116, 438.
[35] *Id.* at 438.
[36] *Id.* at 360 ("[T]he EPA's approach allows states to submit multi-state plans. The EPA expects this flexibility to reduce the cost of achieving the state goals and therefore expects it to be attractive to states. For example, the RGGI-participating states could choose to submit a multi-state mass-based plan that demonstrates emission performance by affected EGUs on a multi-state basis. Additional states may also choose to join a multi-state plan. The mechanics of translating rate-based goals into mass-based goals and considerations related to multi-state plans are discussed below in Section VIII on state plans.")
[37] *State Plan Considerations* at 18 (further providing that "[t]he emission limitation consists of a requirement to submit CO_2 allowances equal to reported CO_2 emissions during a compliance period. While states have individual emission budgets, representing the total number of allowances issued for a given year that are available for allocation, there are no individual state emission limits. The CO_2 emission constraint is regional, based on the sum of state CO_2 emission budgets.")

While this CO_2 budget trading program is enforceable at the state level, EPA admits that "enforceability would be contingent, in part, on states having comparable enforcement mechanisms."

Importantly, each member state, with one exception resulting in multi-year litigation, passed *new legislation* to implement the Model Rule in their respective states and facilitate participation in RGGI.[38] The Model Rule does not supplant state-developed rules, but rather, provides a general organizational structure for states to follow when implementing their own provisions. While this CO_2 budget trading program is enforceable at the state level, EPA admits that "enforceability would be contingent, in part, on states having comparable enforcement mechanisms."[39]

A regional organization (RO) facilitates the ongoing administration of RGGI. The RO (RGGI, Inc.) is a non-profit entity incorporated in Delaware that was created in 2007 to provide technical and administrative support to the member states.[40] It operates pursuant to by-laws agreed upon by the member states.[41] The RO is managed by its Board of Directors, which consists of two directors from each member state, (1) the chair of the state's energy regulatory agency, and (2) the chief executive of the state's environmental regulatory agency, unless the Governor determines that other state officials should act as the state's directors.[42]

c. RGGI Administration and Enforcement

While each participating state is responsible for its own regulatory program, the RO serves as a "forum for collective deliberation and action" and provides technical assistance in implementing certain components of the program, such as auctions, offsets, emissions tracking, and market monitoring.[43] To be sure, Article XII of the RO's By-Laws explains that the RO is a technical assistance organization only, and "shall have no regulatory or enforcement authority with respect to any existing or future program of any Signatory State, and all such sovereign authority is reserved to each Signatory State."[44] In sum, with the technical assistance of the RO, each member state essentially adopts the Model Rule into its preexisting regulatory framework through new state legislation. Importantly, however, the Model Rule, as well as state legislation implementing the Model Rule as modified to a member state's satisfaction, is not enforceable as between the states because the structure lacks an interstate enforcement mechanism and state laws by their very nature cannot result in extraterritorial enforcement.

This calls into question EPA's ability to find that a multi-state SIP premised upon a RGGI-like structure, *i.e.*, a regional entity with mere "technical assistance" authority and a consortium of state laws implemented and enforced at the state level, could be approved under EPA's "general criteria" for SIP evaluation as set forth in the CO_2 Emission Guidelines.

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[38] *See* Connecticut (R.C.S.A 22a-174-31; Conn. Gen. Stat. Section 22a-200c); Delaware (7 DE Admin Code 1147; Title 7 Chapter 60 of the Delaware Code, Subchapter IIA, §6043); Maine (DEP Chapter 156-158; Maine Rev. Stat., Title 38, Chapter 3-B); Maryland (Department of Environment, Title 26, Subtitle 9; Environment Article, §§1-101, 1-404, 2-103, and 2-1002(g), Annotated Code of Maryland); Massachusetts (DEP Regulations 310 CMR 7.70; 225 CMR 13.00; M.G.L. c. 21A, §22); New Hampshire (NH Code of Admin. Rules, Chapter Env-A 4600; Chapter Env-A 4700; Chapter Env-A 4800; RSA 125-O:19-28p; RSA 125-O:8, I(c)-(g)); Rhode Island (Dept. of Environmental Management Office of Air Resources, Air Pollution Control Regulation No. 46 and 47; R.I. Gen. Laws §42-17.1-2(19), §23-23 and §23-82); Vermont (30 V.S.A. § 255; 30 V.S.A. § 209(d)(3); Agency of Natural Resources, Vermont CO2 Budget Trading Program 23-101 – 23-1007). New York did not pass legislation, which resulted in subsequent litigation. However, the court did not consider the merits of the claims because they were time-barred. *See Thrun v. Cuomo*, 112 A.D.3d 1038 (N.Y. App. Div. Dec. 5, 2013).

[39] *State Plan Considerations* at n.19.

[40] 2007 RGGI By-Laws, at Art. I, *available at* http://www.rggi.org/old/docs/rggi_bylaws_12_12_07.pdf.

[41] 2007 RGGI By-Laws, at Art. I.

[42] RGGI By-Laws, at Art. IV, § 1.

[43] RGGI By-Laws, at Art. I.

[44] RGGI By-Laws, at Art. XII.

in the CO_2 Emission Guidelines. States would not be able to enforce the terms of the joint, multi-state SIP *vis-à-vis* one another under a RGGI-like structure. This would likely render the SIP unenforceable, and thus not approvable by EPA, absent an interstate enforcement mechanism.

d. Member State Rivalries and the Practical Need for Enforcement Authority

From a practical standpoint, member states themselves may want interstate enforcement authority to ensure that all member states fulfill their obligations under a multi-state SIP. Member state interests could become rivalrous if and when a state does not fulfill its SIP obligations or through issues involving interstate capacity needs.[45] For instance, in many cases around the nation, electric capacity serving demand in one state comes from another state. A multi-state program makes sense to ensure that a given state's parochial carbon interests do not negatively affect another state's capacity needs.

Under any rivalrous scenario, states would want the ability to enforce the multi-state SIP provisions against the offending member state. While it is valid to point out that state rivalry has not been an issue in RGGI, there is no interstate enforcement provision in the RGGI structure. Moreover, and equally as important, the RGGI cap of allowed emissions from regulated power plants was 165 million tons in 2013, but actual 2012 emissions were only 91 million tons. Emissions were lower than previously anticipated due to low natural gas prices, energy conservation measures, and the struggling economy. Accordingly, with a cap that high, no member state was in severe danger of noncompliance; it is these potential noncompliance scenarios that would lead to an action by one state against another state. In February 2013, the RGGI cap was lowered to 91 million tons for 2014 with 2.5% annual reductions until 2020. Accordingly, the future may hold more rivalrous member state relationships in RGGI with a more restrictive cap.

e. Enter the Interstate Compact

The U.S. Constitution expressly addresses what amounts to contracts between individual states. Article I, section 10, clause 3 of the U.S. Constitution provides that "[n]o State shall, without the consent of Congress … enter into any Agreement or Compact with another State." Interstate compacts can create enforceable obligations between parties, and the U.S. Supreme Court has held for nearly 200 years that compacts are contracts between individual states.[46]

Courts have discussed "some of the indicia of compacts," specifically "establishment of a joint organization for regulatory purposes; conditional consent by member states in which each state is not free to modify or repeal its participation unilaterally; and state enactments which require reciprocal action for their effectiveness."[47] Whether Congressional approval of an interstate compact is required, however, depends upon the nature of the agreement:

> To form a compact, two or more states typically negotiate an agreement, and then each state legislature enacts a law that is identical to the agreement reached. Once all states specified in the compact have enacted such laws, the compact is formed. In some cases, if a compact affects the balance of power between the states and the federal government or affects a power constitutionally delegated to the federal government, it must also obtain congressional consent. In consenting to a compact, Congress may add certain conditions ….[48]

[45] For example, the Missouri Joint Municipal Electric Utility Commission (MJMEUC) is authorized by Missouri state law to operate as an electric utility for the benefit of the combined requirements of its members. MJMEUC has ownership interests in coal-fired generation units in Missouri, Arkansas, Illinois and Nebraska. Accordingly, MJMEUC customers are dependent upon out-of-state generation to meet its capacity needs. If one of these states decides to retire coal-fired generation to meet its single state or multi-state SIP obligations such that reliability and/or affordability is affected, one can easily foresee a rivalrous scenario. This interstate capacity issue exists in the western U.S. as well – the North Valmy Generating Station in Nevada serves Idaho customers (in addition to in-state customers), the Navajo Generating Station in Arizona serves customers in California and Nevada (as well as Arizona), and the Jim Bridger Power Plant in Wyoming serves customers in Idaho and Utah. These provide just a few examples of the widespread interstate capacity issues across the country necessarily implicated by the CO_2 Emission Guidelines.

[46] *Green v. Biddle*, 21 U.S. (8 Wheat.) 1, 92 (1823).

[47] *Seattle Master Builders Ass'n v. Pacific Northeast Electric Power & Conservation Planning Council*, 786 F.2d. 1359, 1363 (9th Cir. 1986).

[48] U.S. Government Accountability Office, *INTERSTATE COMPACTS: An Overview of the Structure and Governance*

For example, a 2007 Government Administrative Office (GAO) study identified 76 environmental and natural resources interstate compacts, and 59 required Congressional approval.[49] The U.S. Supreme Court has wrestled with the line of where Congressional approval of interstate compacts is needed and where it is not several times. In 1893, the Supreme Court held:

> Looking at the clause in which the terms "compact" or "agreement" appear, it is evident that the prohibition is directed to the formation of any combination tending to the increase of political power in the states, which may encroach upon or interfere with the just supremacy of the United States.[50]

Therefore, the Compact Clause applies to agreements directed to the formation of any unit that may increase states' political power encroaching on federal power.[51] Congressional consent is not required for joint state activity not affecting federal authority.[52]

The multi-state enforcement issues with RGGI lead to the conclusion that a contract, in the form of an interstate compact, would be necessary to implement an enforceable multi-state SIP.

According to the analysis developed by the Supreme Court, a court first evaluates whether the agreement or arrangement at issue constitutes a compact. The key component of this analysis involves looking at the "indicia" set forth by the Ninth Circuit in *Seattle Master Builders Association*. If a compact is in fact at issue, courts evaluate if the compact encroaches upon federal power, *i.e.*, whether it is "political." A compact is "political" if it (1) impacts the federal structure or (2) effects the interests of non-compacting sister states.[53] As to the first inquiry, in the words of the Supreme Court, "[t]he relevant inquiry must be one of impact on our federal structure."[54] Courts also consider whether the compact affects the interests of non-compacting sister states. Under either scenario, *i.e.*, impact on federal structure *or* effects on the interest of non-compacting sister states, Congressional approval is required for the compact.[55]

f. Multi-State SIPs and the Compact Clause

The multi-state enforcement issues with RGGI lead to the conclusion that a contract, in the form of an interstate compact, would be necessary to implement an enforceable multi-state SIP that would allow states to enforce rights against one another to achieve compliance with the multi-state performance goal.

Any such agreement would facially have all indicia of a compact: (1) a joint organization formed for regulatory purposes to effectuate compliance with the CO_2 Emission Guidelines; (2) conditional consent by each member state to have no right to modify or repeal its participation unilaterally as this consent would be required to submit an approvable multi-state SIP; and (3) state enactments requiring reciprocal action, as each member state would pass new legislation to allow for participation in the multi-state SIP and achievement of the multi-state performance goal would turn on each member state satisfying its obligations under the multi-state SIP. In fact, while some commentators have questioned whether RGGI was an interstate compact,[56] an agreement to implement multi-state SIPs would even more directly satisfy the *Seattle Master Builders*

of Environment and Natural Resource Compacts, at 1 (Apr. 2007), *available at* http://www.gao.gov/assets/260/258939.pdf.

[49] *Id.*

[50] *Virginia v. Tennessee*, 148 U.S. 503, 519 (1893).

[51] *Northeast Bancorp, Inc. v. Board of Governors of Federal Reserve System*, 472 U.S. 159 (1985).

[52] *Seattle Master Builders Ass'n v. Pacific Northwest Elec. Power and Conservation Planning Council*, 786 F.2d 1359 (9th Cir. 1986).

[53] *U. S. Steel Corp. v. Multistate Tax Comm'n*, 434 U.S. 452, 477 (1978).

[54] *Id.* at 471.

[55] *Id.* at 477. In both *U.S. Steel* and *Northeast Bancorp*, the Supreme Court applied a sister state interest analysis, suggesting that the sister state interest doctrine is in force despite being rejected as a justification for overturning the compacts in those particular cases.

[56] *See, e.g.*, Edison Electric Institute, *Comments to Regional Greenhouse Gas Initiative Memorandum of Understanding*, at 22-24 (Mar. 20, 2006), *available at* http://www.rggi.org/docs/rggi-eeimou_comments032006final.pdf. In addition, the New York state lawsuit regarding the lack of legislation also challenged RGGI in part on grounds that it violated the Compact Clause. However, this case was dismissed without considering the merits by the New York Supreme Court because the all claims were either time-barred or moot. *See Thrun v. Cuomo*, 112 A.D.3d 1038 (N.Y. App. Div. Dec. 5, 2013).

Association factors because states likely could not unilaterally withdraw as they can under RGGI. If member states could unilaterally withdraw, it would raise questions as to whether the multi-state SIP was enforceable between member states and could satisfy EPA's general criteria.

Assuming an agreement or multi-state SIP is in fact a compact, the next question is whether the compact is "political." As to federal structure, a multi-state SIP would appear to impact the federal structure given that the Clean Air Act is a federal statute and the CO_2 Emission Guidelines are promulgated by EPA pursuant to Section 111(d) and its federal implementing regulations. Indeed, a counterargument exists that the Clean Air Act, through its purported embrace of cooperative federalism, actually involves states implementing state-specific programs through SIPs. In other words, it is technically a federal program but there is no federal structure because the states implement and enforce the requirements. However, the former argument would appear to be stronger and, at the very least, would potentially subject a multi-state SIP that did not receive Congressional approval for litigation. Moreover, there is also an argument that a multi-state SIP would interfere with federal authority by potentially affecting the grid reliability.

Second, notwithstanding the analysis above regarding impact on the federal structure, it would almost certainly appear that any interstate compact would require Congressional approval on the basis of effects upon non-compacting sister states. As EPA notes in the CO_2 Emission Guidelines, "[t]he utility power sector is unique in that, unlike other sectors where the sources operate independently and on a local scale, power sources operate in a complex, interconnected grid system that typically is regional in scale."[57] Accordingly, if a subset of states in an interconnected regional grid system entered into a multi-state SIP and associated interstate compact, it would likely affect the interests of the non-compacting states in that region. While the Supreme Court has never rejected an interstate compact on the basis of effects on sister state interests, the multi-state SIP avenue raises a constitutional issue that has not been visited by the Supreme Court for many years. Accordingly, it provides an interesting academic question at a minimum and a likely litigation path for any party seeking to challenge the validity of a multi-state SIP.

It would almost certainly appear that any interstate compact would require Congressional approval on the basis of effects upon non-compacting sister states.

g. Congressional Approval and Timing Issues

The potential need for Congressional approval injects additional political and timing elements into any multi-state SIP process. Indeed, political issues are beyond the scope of this paper but could certainly inject delay into the approval process, as Congressional approval for an interstate compact would likely need to precede EPA approval of any multi-state SIP tied to the interstate compact. In its report, the GAO discusses the process for Congressional approval:

> Congress generally gives its consent in one of three ways: (1) after the fact, by passing legislation that specifically recognizes and consents to the compact as enacted by the states; (2) in advance, by passing legislation encouraging states to enter into a specified compact or compacts for specified purposes; or (3) implied after the fact, when actions by the states and the federal government indicate that Congress has granted its consent even in the absence of a specific legislative act. In addition, Congress may impose conditions as part of granting its consent, and it typically reserves the right to alter, amend, or repeal its consent. Any proposed amendment to a compact must follow the compact approval process, unless the compact specifies otherwise.[58]

The potential need for Congressional approval injects additional political and timing elements into any multi-state SIP process.

Advance approval is irrelevant with regard to Section 111(d) and the CO_2 Emission Guidelines. An example of a statute providing advance Congressional approval of an interstate compact is the Energy Policy Act of 2005, which provided advance Congressional approval

[57] CO_2 Emission Guidelines, at 72.

[58] *Interstate Compacts GAO Report* at 6.

for any interstate compact entered into to address the siting of transmission lines to deliver renewable energy.[59] The Clean Air Act contains no such provision. Accordingly, Congressional approval will come in either the form of express legislation or implication through the actions of states and the federal government. While the express approval avenue could decrease the likelihood of future litigation under the Compact Clause, it also injects significant timing risk into the process because any multi-state SIP would be contingent upon approval of legislation. The "implied consent" avenue mitigates the timing risks, but carries with it the possibility that litigation could be brought for violation of the Compact Clause since no express action occurred. Under these circumstances, the member states would have to establish that Congress did in fact provide implicit consent.

VII. Initial Conclusions and Takeaways

We offer these tentative conclusions and takeaways based upon the above analysis and discussion:

- States have relatively little time to make crucial decisions regarding EPA's proposed rule, including whether to act individually or on a multi-state basis, which of four state plan pathways to take, what state agency(ies) should be responsible to implement a Carbon IRP-like process, how any ISOs or RTOs operating within the state will play a role, and what enforcement and corrective action measures are necessary to ensure compliance with the proposed rule.
- States will need to devise institutional arrangements, which almost certainly will require new legislation, between the state PUC and state environmental regulator to implement carbon-driven resource planning.
- State plans will need to encompass all electric generation units, including those owned or operated by current non-state jurisdictional entities like rural cooperatives and municipal utilities. To the extent a state SIP relies on energy efficiency or demand response, all distribution utilities will need to be brought within carbon IRP planning as well.
- Restructured wholesale markets will require integrated carbon planning across the market areas to ensure adequate capacity and reliability.
- Multi-state plans may be attractive within many regions, particularly when coincident with ISO or RTO footprints.
- Because state interests will be potentially rivalrous, multi-state SIPs will need an enforcement mechanism and may well require congressionally-approved interstate compacts to satisfy EPA requirements of enforceability.
- State SIPs that are adjudged by EPA to be inadequate in terms of enforceable, quantifiable and verifiable reductions of EGU CO_2 emissions equivalent to EPA's goals, and implementation of corrective actions, if necessary, will result in a FIP. A FIP creates legal issues of whether EPA has the authority to force state officials to enforce obligations they do not have authority to enforce under state law, and to engage in resource planning and direct system dispatch.

* * *

[59] Energy Policy Act of 2005, Title XII, Subtitle B, Section 1221. The statutory section provides:

> (i) INTERSTATE COMPACTS.—(1) The consent of Congress is given for three or more contiguous States to enter into an interstate compact, subject to approval by Congress, establishing regional transmission siting agencies to—
>
> (A) facilitate siting of future electric energy transmission facilities within those States; and
>
> (B) carry out the electric energy transmission siting responsibilities of those States.
>
> (2) The Secretary may provide technical assistance to regional transmission siting agencies established under this subsection.
>
> (3) The regional transmission siting agencies shall have the authority to review, certify, and permit siting of transmission facilities, including facilities in national interest electric transmission corridors (other than facilities on property owned by the United States).

To date, no interstate compacts have been entered into under the statute.

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EMPLOYMENT EXPERIENCE

Wilkinson Barker Knauer LLP – *June 2012 to present*

Partner: As part of Denver office of WBK, practice focuses on energy and telecommunications matters, including transmission line development, smart grid/demand response, rate cases, resource planning, renewable and conventional energy, commercial contracts, rulemakings, state PUC issues

Squire Sanders & Dempsey – *April 2007 to June 2012*

Of Counsel: Co-founder of SSD Denver Office for regulatory practice in Rocky Mountain region, with emphasis in telecommunications, electric and gas regulatory work, including: high cost fund support; generation resource planning; renewable energy; transmission line development; commercial contracts with energy vendors and demand side management firms; rulemakings; rate cases

Colorado Public Utilities Commission – *January 2003 to January 2007*

Chairman: Responsibilities included conducting quasi-judicial and quasi-legislative proceedings; drafting legal decisions; meeting with the governor, legislators, and utilities regarding proposed legislation; investigating service outages; understanding and deliberating on Phase I and II electric rate cases, generation planning, quality of service, and telecommunications service regulation

Major Cases: Redrafting PUC regulatory rules – Electric, Gas, Telecommunications; 750 MW coal plant certification; Xcel and Aquila rate cases; Xcel integrated resource generation planning; implementation of renewable energy mandates; transmission line approval and disputes; electric price response pilot program; Qwest deregulation case; high cost fund administration; rulemakings

Gorsuch Kirgis LLP - *August 2000 to January 2003*

Senior Assoc: Litigation practice with emphasis in representing electric, gas, and telecommunications utilities before PUC; commercial practice before state and federal district and appellate courts

Colorado Attorney General's Office - *September 1997 to August 2000*

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Wells, Anderson & Race LLC - *September 1995 to September 1997*

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University of Colorado Law Review

University of Illinois, May, 1988
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4.56 GPA on 5.0 scale (High Honors)

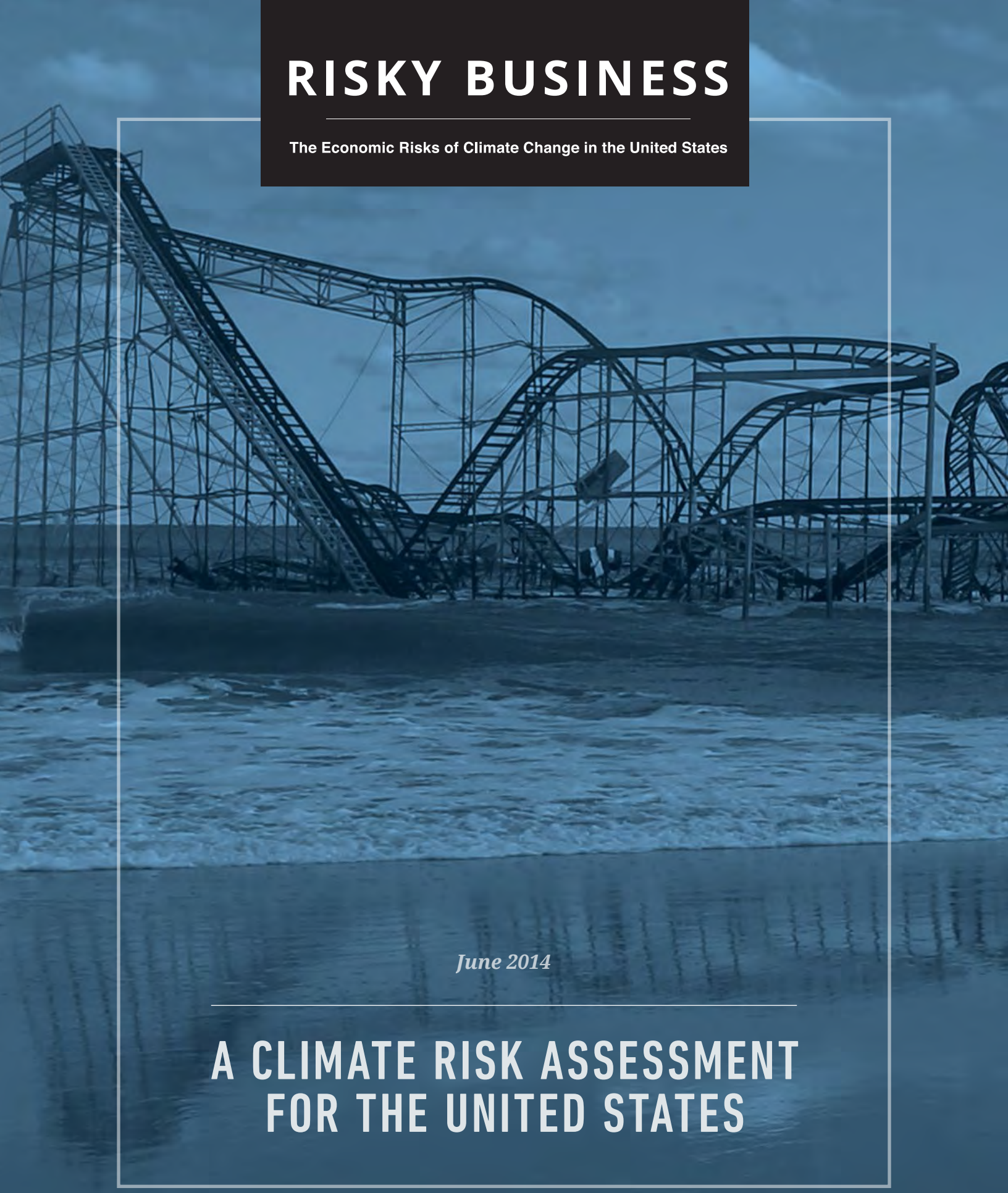
SPEECHES AND PAPERS

I have given speeches and presented papers to, among others, the Federal Communications Bar Association, Colorado Bar Association, University of Colorado, CLE International, National Association of Regulatory Utility Commissioners, Federalist Society, Western Chapter of the Energy Bar Association, Silicon Flatirons Telecommunications Program, Colorado Rural Energy Association, Midwest Energy Association, EUCI, and Law Seminars International regarding the following topics:

- Federal Energy Policy Act of 2005
- Solar and wind energy development
- Natural gas price volatility
- Generation resources, planning, and reliability
- RPS Mandates
- Transmission Line Disputes
- Rate Case issues
- Regional Transmission Organizations and Standard Market Design
- Renewable energy and demand side management
- Advanced meter and price response programs
- Federal and state telecommunications jurisdiction and preemption
- Legal and policy issues related to VoIP, wireless services, the Universal Service Fund, unbundled network elements, and inter-carrier compensation
- Rural ILEC issues and disputes
- Telecommunications Act of 1996
- Telecommunications deregulation

RISKY BUSINESS

The Economic Risks of Climate Change in the United States



June 2014

A CLIMATE RISK ASSESSMENT FOR THE UNITED STATES

RISKY BUSINESS: The Economic Risks of Climate Change in the United States

A Product of the Risky Business Project:

RISKY BUSINESS

The Economic Risks of Climate Change in the United States

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Lead Authors Kate Gordon, Executive Director of the Risky Business Project, drawing from independent research commissioned by the Risky Business Project. Special thanks to Matt Lewis, Risky Business Project Communications Director, and Jamesine Rogers, Risky Business Project Manager, for their editorial support.

Research Risky Business Project co-chairs Michael R. Bloomberg, Henry Paulson, and Tom Steyer tasked the Rhodium Group, an economic research firm that specializes in analyzing disruptive global trends, with an independent assessment of the economic risks posed by a changing climate in the U.S. Rhodium convened a research team co-led by Dr. Robert Kopp of Rutgers University and economist Dr. Solomon Hsiang of the University of California, Berkeley. Rhodium also partnered with Risk Management Solutions (RMS), the world's largest catastrophe-modeling company for insurance, reinsurance, and investment-management companies around the world. The team leveraged recent advances in climate modeling, econometric research, private sector risk assessment, and scalable cloud computing (processing over 20 terabytes of climate and economic data) to provide decision-makers with empirically-grounded and spatially-explicit information about the climate risks they face. The team's complete assessment, along with technical appendices, is available at Rhodium's website, **climateprospectus.rhg.com**. Interactive maps and other content associated with the Risky Business Project are located at **riskybusiness.org**.

The research team's work was reviewed by an independent Risky Business Expert Review Panel composed of leading climate scientists and economists. A full list of the expert review panel is available on Rhodium's website.

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PLEASE NOTE: Several numbers in this report were updated on July 18, 2014 to reflect the most current data from the American Climate Prospectus.

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EXECUTIVE SUMMARY

Damages from storms, flooding, and heat waves are already costing local economies billions of dollars—we saw that firsthand in New York City with Hurricane Sandy. With the oceans rising and the climate changing, the Risky Business report details the costs of inaction in ways that are easy to understand in dollars and cents—and impossible to ignore.

— Risky Business Project Co-Chair Michael R. Bloomberg [1]

The U.S. faces significant and diverse economic risks from climate change. The signature effects of human-induced climate change—rising seas, increased damage from storm surge, more frequent bouts of extreme heat—all have specific, measurable impacts on our nation's current assets and ongoing economic activity.

To date, there has been no comprehensive assessment of the economic risks our nation faces from the changing climate. *Risky Business: The Economic Risks of Climate Change to the United States* uses a standard risk-assessment approach to determine the range of potential consequences for each region of the U.S.—as well as for selected sectors of the economy—if we continue on our current path. The Risky Business research focused on the clearest and most economically significant of these risks: **Damage to coastal property and infrastructure from rising sea levels and increased storm surge, climate-driven changes in agricultural production and energy demand, and the impact of higher temperatures on labor productivity and public health.**

Our research combines peer-reviewed climate science projections through the year 2100 with empirically-derived estimates of the impact of projected changes in temperature, precipitation, sea levels, and storm activity on the U.S. economy. We analyze not only those outcomes most likely to occur, but also lower-probability

EXECUTIVE SUMMARY

high-cost climate futures. Unlike any other study to date, we also provide geographic granularity for the impacts we quantify, in some cases providing county-level results.

Our findings show that, if we continue on our current path, many regions of the U.S. face the prospect of serious economic effects from climate change. However, if we choose a different path—if we act aggressively to both adapt to the changing climate and to mitigate future impacts by reducing carbon emissions—we can significantly reduce our exposure to the worst economic risks from climate change, and also demonstrate global leadership on climate.

Climate Change: Nature's Interest-Only Loan

Our research focuses on climate impacts from today out to the year 2100, which may seem far off to many investors and policymakers. But climate impacts are unusual in that future risks are directly tied to present decisions. Carbon dioxide and other greenhouse gases can stay in the atmosphere for hundreds or even thousands of years. Higher concentrations of these gases create a "greenhouse effect" and lead to higher temperatures, higher sea levels, and shifts in global weather patterns. The effects are cumulative: By not acting to lower

SHORT-TERM CLIMATE THREATS

The American economy is already beginning to feel the effects of climate change. These impacts will likely grow materially over the next 5 to 25 years and affect the future performance of today's business and investment decisions in the following areas:

Coastal property and infrastructure. **Within the next 15 years, higher sea levels combined with storm surge will likely increase the average annual cost of coastal storms along the Eastern Seaboard and the Gulf of Mexico by $2 billion to $3.5 billion. Adding in potential changes in hurricane activity, the likely increase in average annual losses grows to up to $7.3 billion, bringing the total annual price tag for hurricanes and other coastal storms to $35 billion.**

Agriculture. **A defining characteristic of agriculture in the U.S. is its ability to adapt. But the adaptation challenge going forward for certain farmers in specific counties in the Midwest and South will be significant. Without adaptation, some Midwestern and Southern counties could see a decline in yields of more than 10% over the next 5 to 25 years should they continue to sow corn, wheat, soy and cotton, with a 1-in-20 chance of yield losses of these crops of more than 20%.**

Energy. **Greenhouse gas-driven changes in temperature will likely necessitate the construction of up to 95 gigawatts of new power generation capacity over the next 5 to 25 years—the equivalent of roughly 200 average coal or natural gas-fired power plants—costing residential and commercial ratepayers up to $12 billion per year.**

EXECUTIVE SUMMARY

greenhouse gas emissions today, decision-makers put in place processes that increase overall risks tomorrow, and each year those decision-makers fail to act serves to broaden and deepen those risks. In some ways, climate change is like an interest-only loan we are putting on the backs of future generations: They will be stuck paying off the cumulative interest on the greenhouse gas emissions we're putting into the atmosphere now, with no possibility of actually paying down that "emissions principal."

Our key findings underscore the reality that if we stay on our current emissions path, our climate risks will multiply and accumulate as the decades tick by. These risks include:

- **Large-scale losses of coastal property and infrastructure**
  - » If we continue on our current path, by 2050 between $66 billion and $106 billion worth of existing coastal property will likely be below sea level nationwide, with $238 billion to $507 billion worth of property below sea level by 2100.
  - » There is a 1-in-20 chance—about the same chance as an American developing colon cancer; twice as likely as an American developing melanoma[2]—that by the end of this century, more than $701 billion worth of existing coastal property will be below mean sea levels, with more than $730 billion of additional property at risk during high tide. By the same measure of probability, average annual losses from hurricanes and other coastal storms along the Eastern Seaboard and the Gulf of Mexico will grow by more than $42 billion due to sea level rise alone. Potential changes in hurricane activity could raise this figure to $108 billion.
  - » Property losses from sea level rise are concentrated in specific regions of the U.S., especially on the Southeast and Atlantic coasts, where the rise is higher and the losses far greater than the national average.
- **Extreme heat across the nation—especially in the Southwest, Southeast, and Upper Midwest—threatening labor productivity, human health, and energy systems**
  - » By the middle of this century, the average American will likely see 27 to 50 days over 95°F each year—two to more than three times the average annual number of 95°F days we've seen over the past 30 years. By the end of this century, this number will likely reach 45 to 96 days over 95°F each year on average.
  - » As with sea level rise, these national averages mask regional extremes, especially in the Southwest, Southeast, and upper Midwest, which will likely see several *months* of 95°F days each year.
  - » Labor productivity of outdoor workers, such as those working in construction, utility maintenance, landscaping, and agriculture, could be reduced by as much as 3%, particularly in the Southeast. For context, labor productivity across the entire U.S. labor force declined about 1.5% during the famous "productivity slowdown" in the 1970s.[3]
  - » Over the longer term, during portions of the year, extreme heat could surpass the threshold at which the human body can no longer maintain a normal core temperature without air conditioning, which we measure using a "Humid Heat Stroke Index" (HHSI). During these periods, anyone whose job requires them to work outdoors, as well as anyone lacking

access to air conditioning, will face severe health risks and potential death.

» Demand for electricity for air conditioning will surge in those parts of the country facing the most extreme temperature increases, straining regional generation and transmission capacity and driving up costs for consumers.

- **Shifting agricultural patterns and crop yields, with likely gains for Northern farmers offset by losses in the Midwest and South**

» As extreme heat spreads across the middle of the country by the end of the century, some states in the Southeast, lower Great Plains, and Midwest risk up to a 50% to 70% loss in average annual crop yields (corn, soy, cotton, and wheat), absent agricultural adaptation.

» At the same time, warmer temperatures and carbon fertilization may improve agricultural productivity and crop yields in the upper Great Plains and other northern states.

» Food systems are resilient at a national and global level, and agricultural producers have proven themselves extremely able to adapt to changing climate conditions. These shifts, however, still carry risks for the individual farming communities most vulnerable to projected climatic changes.

The Risky Business Project is designed to highlight climate risks to specific business sectors and regions of the economy, and to provide actionable data at a geographically granular level for decision-makers. It is our hope that it becomes standard practice for the American business and investment community to factor climate change into its decision-making process. We are already seeing this response from the agricultural and national security sectors; we are starting to see it from the bond markets and utilities as well. But business still tends to respond only to the extent that these risks intersect with core short term financial and planning decisions.

We also know that the private sector does not operate in a vacuum, and that the economy runs most smoothly when government sets a consistent policy and a regulatory framework within which business has the freedom to operate. Right now, cities and businesses are scrambling to adapt to a changing climate without sufficient federal government support, resulting in a virtual "unfunded mandate by omission" to deal with climate at the local level.[4] We believe that American businesses should play an active role in helping the public sector determine how best to react to the risks and costs posed by climate change, and how to set the rules that move the country forward in a new, more sustainable direction.

With this report, we call on the American business community to rise to the challenge and lead the way in helping reduce climate risks. We hope the Risky Business Project will facilitate this action by providing critical information about how climate change may affect key sectors and regions of our national economy.

This is only a first step, but it's a step toward getting America on a new path leading to a more secure, more certain economic future.

New York Stock Exchange underwater after Hurricane Sandy

INTRODUCTION

Americans understand risk. Our ability to evaluate risk—to take calculated plunges into new ventures and economic directions and to innovate constantly to bring down those risks—has contributed immensely to the nation's preeminence in the global economy. From the private sector's pioneering venture-capital financing model to the government's willingness to invest in early-stage inventions like the computer chip or the solar panel, our nation's ability to identify and manage potential risks has moved the economy forward in exciting and profitable directions.

The Risky Business Project is designed to apply risk assessment to the critical issue of climate change, and to take a sober, fact-based look at the potential risks facing specific sectors and regions of the national economy. As in a classic business risk assessment, we analyzed not only the most likely scenarios, but also the scenarios that, while less likely, could have more significant impacts.

Our conclusion: The American economy faces multiple and significant risks from climate change. Climate conditions vary dramatically across the U.S., as does the mix of economic activity. Those variations will benefit our economic resilience to future climatic changes. But each region of the country has a different risk profile and a different ability to manage that risk. There is no single top-line number that represents the cost of climate change to the American economy as a whole: We must take a regional approach to fully understand our climate risk.

Given the range and extent of the climate risks the American economy faces, it is clear that staying on our current path will only increase our exposure. The U.S. climate is paying the price today for business decisions made many years ago, especially through increased coastal storm damage and more extreme heat in parts of the country. Every year that goes by without a comprehensive public and private sector response to climate change is a year that locks in future climate events that will have a far more devastating effect on our local, regional, and national economies. Moreover, both government and the private sector are making investment decisions today—whether in property, long-term infrastructure or regional and national supply chains—that will be directly affected by climate change in decades to come.

Road washed away by extreme flood in Jamestown, Colorado

Our assessment finds that, if we act now, the U.S. can still avoid most of the worst impacts and significantly reduce the odds of costly climate outcomes—but only if we start changing our business and public policy practices today.

The Risky Business Project does not dictate the solutions to climate change; while we fully believe the U.S. can respond to these risks through climate preparedness and mitigation, we do not argue for a specific set or combination of these policies. Rather, we document the risks and leave it to decision-makers in the business and policy communities to determine their own tolerance for, and specific reactions to, those risks.

A couple is rescued from their home on Galveston Island, Texas, after a hurricane

UNDERSTANDING CLIMATE RISK

I know a lot about financial risks—in fact, I spent nearly my whole career managing risks and dealing with financial crisis. Today I see another type of crisis looming: A climate crisis. And while not financial in nature, it threatens our economy just the same.

— Risky Business Project Co-Chair Henry Paulson [5]

In order to know how to best respond to climate change, we first need to fully understand the risks it presents. This is our core principle. As Risky Business Project Co-Chair Michael Bloomberg observes, "If you can't measure it, you can't manage it."[6]

Assessing and managing risk is how businesses, militaries and governments are able to remain productive and successful in an increasingly complex, volatile, and unpredictable global economy.

DEFINING RISK

The risk of a future event can be described as *the probability (or likelihood) of that event combined with the severity of its consequences.* The combination of likelihood and severity determines whether a risk is high or low. For instance, a highly likely event with minimal consequences would register as a moderate risk; a low probability event, if it has potentially catastrophic impacts, could constitute a significant risk. These low-probability/high-impact risks are generally referred to as "tail risks."

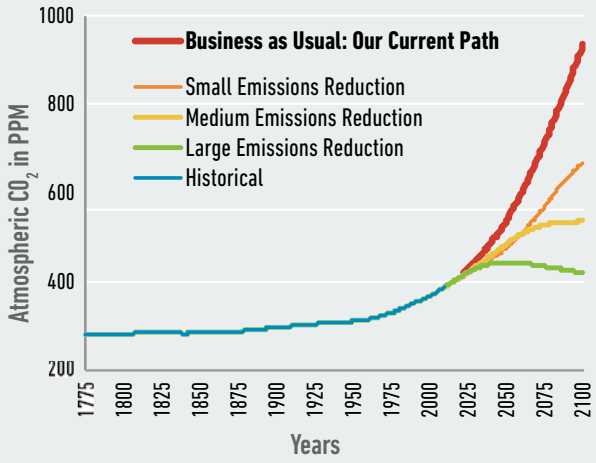
The Risky Business assessment evaluates a range of economic risks presented by climate change in the U.S., including both those outcomes considered most likely to occur and lower probability climate futures that would be either considerably better or considerably worse than the likely range. This is a common risk assessment approach in other areas with potentially catastrophic outcomes, including disaster management, public health, defense planning, and terrorism prevention.

In presenting our results we use the term *"likely"* to describe outcomes with at least a 67% (or 2-in-3) chance of occurring. In discussing tail risks, we generally describe results as having a *1-in-20* chance (or 5%) of being worse than (or better than) a particular threshold. Where the science allows it, we also describe *1-in-100* outcomes, or those with a 1% chance of occurring.

UNDERSTANDING CLIMATE RISK

The risk approach is well suited to the issue of climate change. Even the single term "climate change" is shorthand for a diverse array of impacts, mostly stemming from increased heat in the atmosphere and oceans, but also radiating outward in myriad and geographically diverse ways. For example, in some regions sea levels will likely rise, while in others they may actually fall. In some areas we will likely see increased droughts, whereas in others the combination of heat and humidity could lead to physically unbearable outdoor conditions, with increased risk of heat stroke for the many Americans who work outdoors in sectors such as construction, utility maintenance, transportation, and agriculture.

Figure 1: Global Emissions Scenarios



Our research examines the risks of the U.S. continuing on its current path, or "business as usual." Alternate pathways that include investments in adaptation or policy efforts to mitigate climate change through lowering carbon emissions could significantly reduce these risks.

Data Source: Rhodium Group

Moreover, all these conditions can and will change based on the actions we take today and into the future, as well as on unknowable factors such as the precise rate of Arctic and Antarctic ice melt. Thus the "change" part of climate change is the crux of the matter: **To plan for climate change, we must plan for volatility and disruption.**[7]

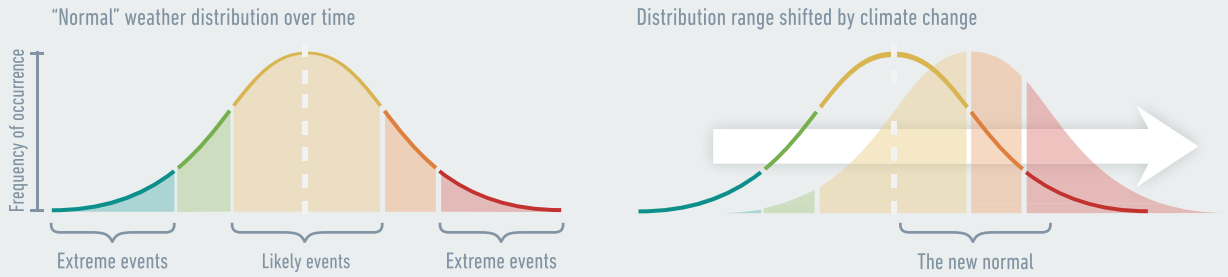
Risk assessment gives businesses a way to plan for change. From PricewaterhouseCoopers's 2008 primer, "A Practical Guide to Risk Assessment":

> The ability to identify, assess, and manage risk is often indicative of an organization's ability to respond and adapt to change. Risk assessment . . . helps organizations to quickly recognize potential adverse events, be more proactive and forward-looking, and establish appropriate risk responses, thereby reducing surprises and the costs or losses associated with business disruptions. This is where risk assessment's real value lies: in preventing or minimizing negative surprises and unearthing new opportunities.[8]

The Risky Business Project examines the risks of the U.S. continuing on its current path, or "business as usual." This assumes no new national policy or global action to mitigate climate change and an absence of investments aimed at improving our resilience to future climate impacts. Taking these policy and adaptive actions could significantly reduce the risks we face, as illustrated in Figure 1.

Our research analyzes the risks of "business as usual" to specific critical sectors of the economy and regions of the country. We focus in particular on sectors that are already making large, expensive investments in

Figure 2: How Extreme Weather Events Become the Norm



Human society is structured around "normal" weather, with some days hotter than average and some colder. At the distant "tails" are extreme events such as catastrophic weather. Climate change shifts the entire distribution curve to the right. Old extremes become the new normal, new extremes emerge, and the process continues until we take action.

Source: Risky Business

infrastructure that will likely last well into the future: **agriculture, energy, and coastal infrastructure.** We also look at the impact of climate change on America's **labor productivity and public health,** which influence multiple economic sectors. These latter impacts also are deeply connected to our shared future quality of life.

As with any risk assessment, our investigation looks at not only the most likely outcomes, but also climate futures that have a lower probability of occurring but particularly severe consequences should they come to pass. (See "Defining Risk" sidebar, p. 9.) This focus on "tail risks" is not unique to climate change. After all, households and businesses pay a premium for insurance to protect themselves against those tail risks, such as the possibility of flood or fire, that they deem unacceptable. The military plans for a wide range of possible (and sometimes highly unlikely) conflict scenarios, and public health officials prepare for pandemics of low or unknown probability.

When looking at climate change, it's particularly important to consider the outlier events and not just the most likely scenarios. Indeed, the "outlier" 1-in-100 year event today will become the 1-in-10 year event as the Earth continues to warm. Put another way, **over time the extremes will become the "new normal."**

"Risk is like fire: If controlled it will help you; if uncontrolled it will rise up and destroy you."

— Theodore Roosevelt

RESULTS: RISKS VARY BY REGION & SECTOR

Talking about climate change in terms of U.S. averages is like saying, 'My head is in the refrigerator, and my feet are in the oven, so overall I'm average.'

— Risky Business Project Co-Chair Tom Steyer [9]

Our risk assessment begins with the straightforward fact that human-induced climate change leads to rising temperatures.

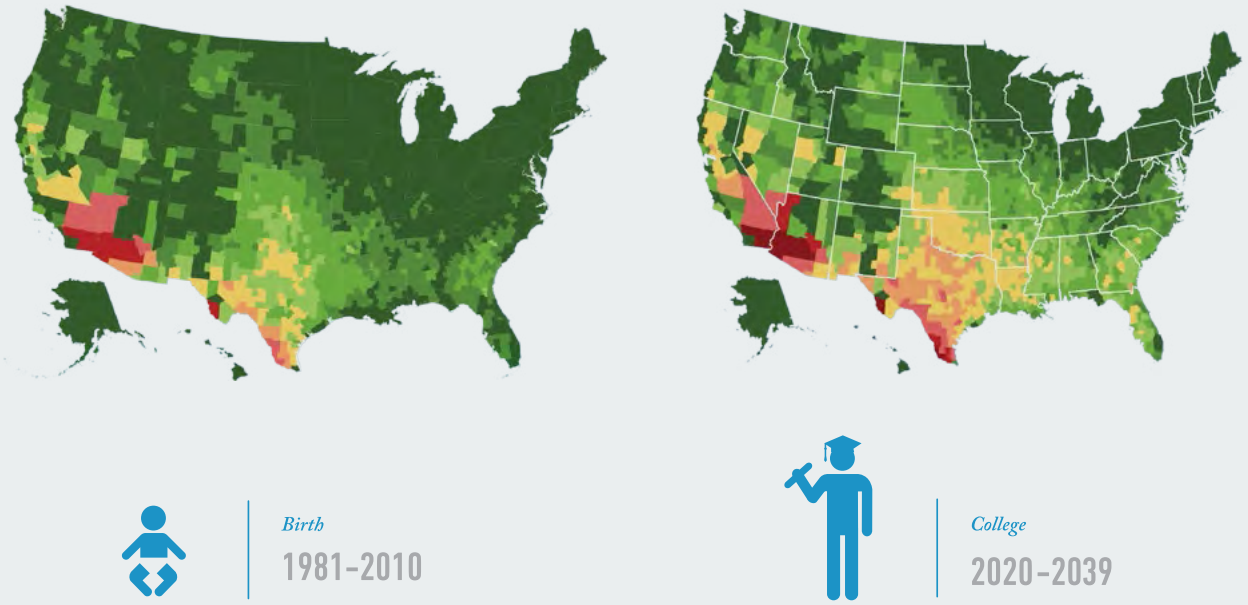
If we continue along our current path, with no significant efforts to curb climate change, the U.S. will likely see significantly more days above 95°F each year. By the middle of this century, the average American will likely see 27 to 50 days over 95°F each year—from double to more than triple the average number of 95°F days we've seen over the past 30 to 40 years. Climate change impacts only accelerate with time, so that by the end of this century we will likely see 45 to 96 days per year over 95°F. That's between one and a half and three months of the year at what are now considered record hot temperatures. To put this in context, by the end of the century, Oregon, Washington, and Idaho could well have more days above 95°F each year than there are currently in Texas.

These are only the most likely scenarios; there are possible lower and higher estimates outside the most likely range. Within that range, there are also disparities, of course: As the maps that follow demonstrate, some regions of the country will be far harder hit by extreme heat than others, and some will experience rising temperatures in terms of warmer winters rather than unbearable summers.

What matters isn't just the heat, it's the humidity—or, in this case, a dangerous combination of the two. One of the most striking findings in our analysis is that increasing heat and humidity in some parts of the country could lead to outside conditions that are literally unbearable to humans, who must maintain a skin temperature below 95°F in order to effectively cool down and avoid fatal heat stroke. The U.S. has never yet seen a day exceeding this threshold on what we call the "Humid Heat Stroke Index," but if we continue on our current climate path, this will change, with residents in the eastern half of the U.S. experiencing 1 such day a year on average by century's end and nearly 13 such days per year into the next century.

RESULTS: RISKS VARY BY REGION & SECTOR

Figure 3: Average Days Over 95°F: Projections Mapped Over a Lifetime



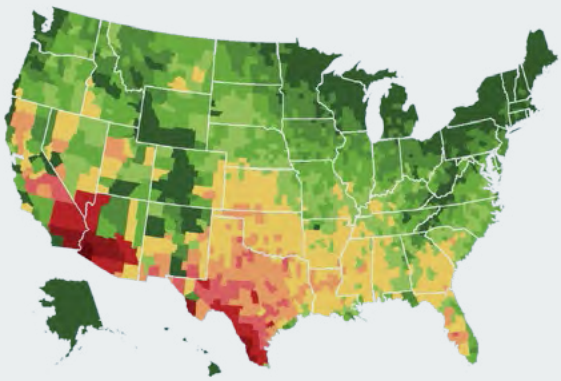
Heat Map Key:

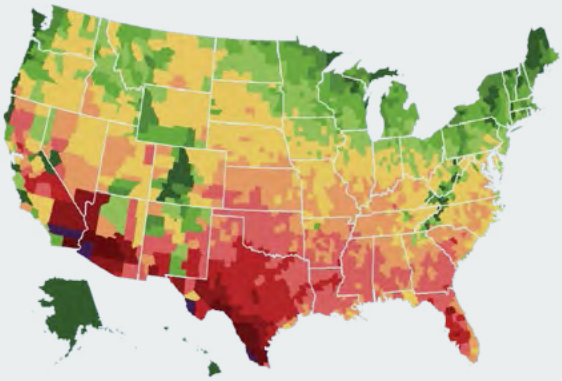
Average Days Per Year Over 95°F

On our current path, the U.S. will likely see significantly more days above 95°F each year. Some regions of the country will be hit far harder by extreme heat than others, and some will experience rising temperatures in terms of warmer winters rather than unbearable summers. But by the end of this century, the average American will likely see 45 to 96 days per year over 95°F.

Data Source: Rhodium Group

RESULTS: RISKS VARY BY REGION & SECTOR





Adulthood
2040–2059

Retirement
2080–2099

By the end of the century, Oregon, Washington, and Idaho could well have more days above 95°F each year than there are currently in Texas; babies being born right now in the Southwest could see nearly four additional months of days over 95°F within their lifetimes.

Regional Impacts Key:

Decreased Labor

Sea Level Rise

Property Loss

Mortality

Heat Stroke

Extreme Heat

Crop Yields

Storm Surge

Energy

RESULTS: RISKS VARY BY REGION & SECTOR

Heat is a critical issue for the health of businesses as well as that of human beings. On their own, rising temperatures can have significant negative impacts on health and also labor productivity. But high temperatures are also at the root of several other important climate impacts that have long been recognized by scientists:

- Hotter air on the Earth's surface leads to higher ocean temperatures, which causes ocean expansion and sea level rise;
- Higher temperatures accelerate the rates at which land ice melts, further elevating average sea levels;
- A warmer atmosphere makes extreme precipitation more likely, which is expected to make wet regions even wetter, but could also make dry regions even drier.

Because the U.S. is such a large and geographically diverse country, it will experience every one of these climate impacts in the next century. Even the individual sectors we studied have regional variations: For agriculture, for instance, the national story is one of an industry able to adapt by changing where and what farmers plant; at the same time, the story within particular regions is quite different, as individual farmers potentially abandon traditional crops or move away from the farming business altogether. For the energy industry, the story in the warming North is starkly different than in the increasingly unbearably hot South. Sea levels, too, vary significantly across the U.S., and even across cities along the same coastline: For example, sea level rise at New York will likely be higher than at Boston, and sea level rise at San Diego will likely be higher than at San Francisco.

As in a standard business risk assessment, we looked at the data to see exactly where the greatest risks lie, and confirmed that some regions and economic sectors face extreme and unacceptable risks. These are some of our gravest concerns:

Rising seas and greater coastal storm damage already threaten the financial value and viability of many properties and infrastructure along the Eastern Seaboard and Gulf Coast. If we stay on our current climate path, some homes and commercial properties with 30-year mortgages in places in Virginia, North Carolina, New Jersey, Alabama, Florida, and Louisiana and elsewhere could quite literally be underwater before the note is paid off.

Rising temperatures will also reduce labor productivity, as some regions—especially the Southeast and Southwest—become too hot by mid-century for people to work outside during parts of the day.

Heat will also put strains on our energy system, simultaneously decreasing system efficiency and performance as system operators struggle to cool down facilities, and increasing electricity consumption and costs due to a surge in demand for air conditioning.

As parts of the nation heat up, the worst health impacts will be felt among the poor—many of whom work or even live outdoors or can't afford air conditioning at home—and among those too elderly or frail to physically withstand the heat or get themselves to air-conditioned facilities.

More than any other factor, our direct economic exposure to climate change will be determined by where we do business. For that reason, we present our findings below in terms of the major regions of the U.S., and then identify how climate change will affect critical sectors within those regions. Still, as any business person knows, these impacts won't be contained within regional boundaries; the ripple effects are likely to resonate throughout the economy. Put another way, just because it's not hot where you are doesn't mean you won't feel the heat of climate change.

Man wades through floodwaters in Immokalee, Florida, after Hurricane Wilma

THE REGIONS

The Risky Business analysis builds on the research and analytical work done over the past several decades by international climate scientists and economists, including the recent National Climate Assessment (NCA), released in early May 2014. The Risky Business Project takes as our unit of measurement the National Climate Assessment regions, which are organized loosely around shared geologic characteristics and climate impacts.[10] These are: Northeast, Southeast, Midwest, Southwest, Great Plains, Northwest, Alaska, and Hawaii.

However, we went even deeper than the NCA, conducting analysis down to the county level in some cases, and also focusing on key economic sectors. We overlaid our regional climate impact findings with an economic analysis showing the potential cost of these impacts within those regions and sectors. Below, we explore the most striking findings from each region. We encourage readers to go to **riskybusiness.org** to explore these regional impacts in more depth and to **climateprospectus.rhg.com** for the independent research team's complete risk assessment.

WHY REGIONS MATTER

In a country as large and diverse as the U.S., it does not make sense to aggregate the highly localized economic impacts of climate change into one headline number. Take the case of Hurricane Katrina: In the last quarter of 2005, every state in the nation prospered except the state of Louisiana, which lost 1.6% of Gross State Product (GSP) as businesses were shuttered and workers stayed home;[11] meanwhile the following year, storm recovery activities in Louisiana (e.g., construction) actually *increased* the national Gross Domestic Product (GDP) by half a percent.[12] Indeed, most economic successes and disasters in the U.S. happen at the individual metropolitan, state, and occasionally multi-state level.

Regions also have a cultural dimension: Americans often think of themselves as "belonging" to specific regions, according to Joel Garreau's famous 1981 book *The Nine Nations of North America*. Garreau posits that Americans live in nine completely different cultural and economic zones. He writes: "Each has a peculiar economy; each commands a certain emotional allegiance from its citizens. These nations look different, feel different, and sound different from each other, and few of their boundaries match the political lines drawn on current maps."[13] Garreau's observations underscore the fact that as mobile as many Americans are, we're still often unwilling or unable to move out of our home regions simply because of weather or economic changes.

The regional nature of climate impacts and the regional nature of the overall American economy and cultural identity mean that there may not be one single national response to the risks highlighted by the Risky Business Project. But the reality of these impacts, especially in the Southwest and Southeast—which will likely experience the most extreme heat and sea level rise over this century—may also mean that Americans have no choice but to migrate to cooler and more livable areas, disrupting lives, livelihoods, and regional identities formed over generations.

NORTHEAST

While the Northeast region of the U.S. is expected to experience a sizeable increase in temperatures and average number of extremely hot days over the course of the century, the region's major climate impact will be sea level rise and its effect on coastal infrastructure.

Rising sea levels are a direct consequence of rising temperatures: As the oceans warm, they expand. This phenomenon is further exacerbated by land-ice melt, particularly the Antarctic and Greenland ice sheets. Scientists have recently found evidence of accelerating and perhaps unstoppable land ice melt in West Antarctica.[14] A further (and more minor) contributor to sea level rise is groundwater withdrawal, which can literally sink the land adjacent to the ocean. All of these factors—thermal expansion, ice melt, and groundwater withdrawal—can lead to higher water levels along the coasts.

Why do sea levels matter to the American economy? First and foremost, sea level rise threatens the communities and industries along our coastlines. The coasts are critical to the Northeast region's economy: Its major cities are on the water, as are many of its major industries, from New York's Wall Street to the fisheries in Portland, Maine. All told, 88% of the population of this region lives in coastal counties, and 68% of the region's Gross Domestic Product (GDP) is generated in those counties. As a result, much of the region's residential, commercial, and energy infrastructure is also at or near sea level, making these assets particularly vulnerable to climate impacts.

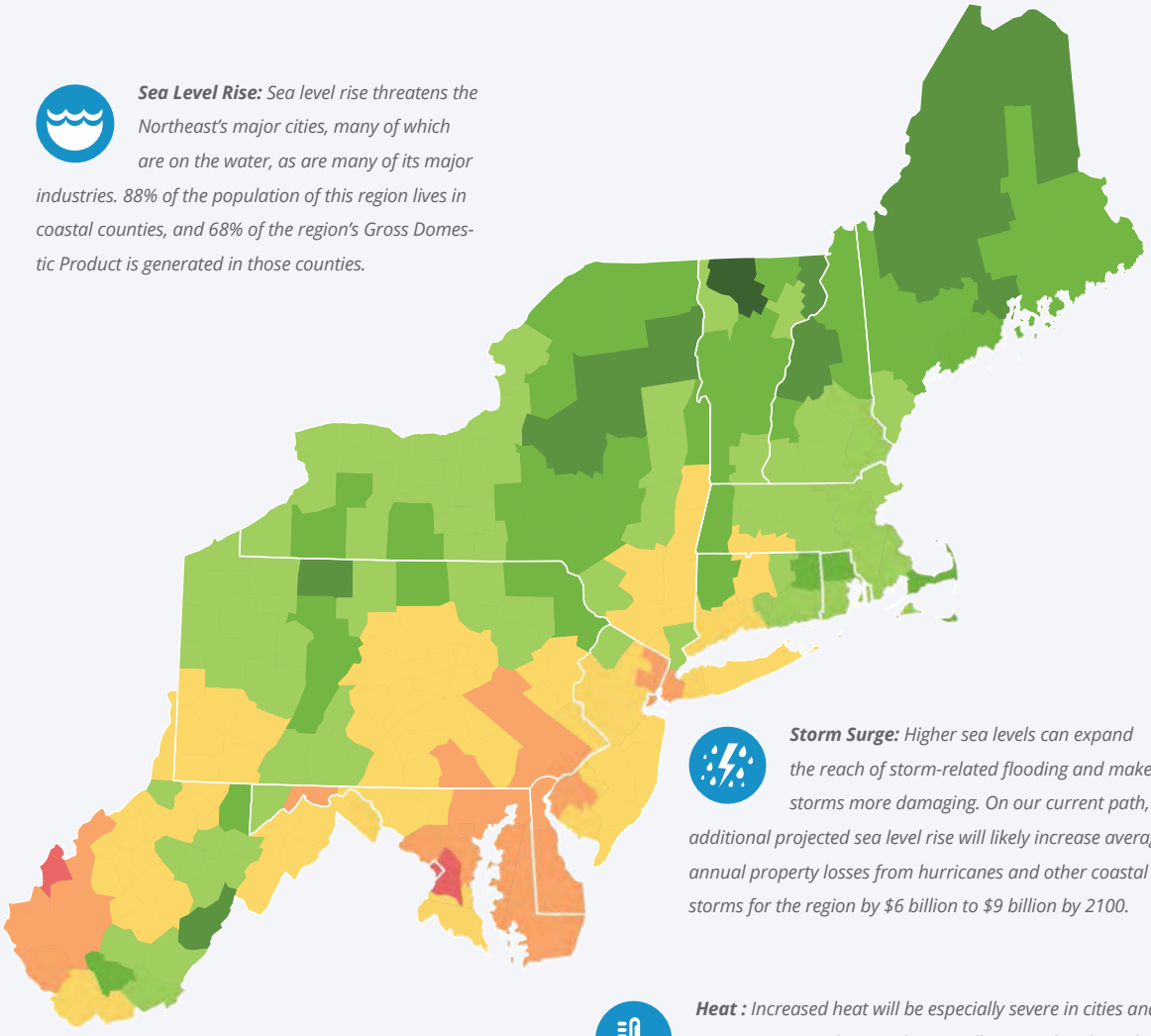
Homeowners look over damage from New York City storm

The Risky Business analysis shows that if we continue on our current path, sea levels at New York City will likely rise by an additional 0.9 feet to 1.6 feet by mid-century, and between 2.1 feet and 4.2 feet by the end of the century. Because our risk assessment includes less likely but higher-impact possibilities, we also found a 1-in-100 chance that New York City could experience more than 6.9 feet of sea level rise by the end of the century. The story for New Jersey is even more concerning because of that state's groundwater withdrawal: It's likely that, on our current path, Atlantic City will see 2.4 feet to 4.5 feet of sea

NORTHEAST

NORTHEAST: AVERAGE SUMMER TEMPERATURE BY 2100 & KEY IMPACTS

Sea Level Rise: *Sea level rise threatens the Northeast's major cities, many of which are on the water, as are many of its major industries. 88% of the population of this region lives in coastal counties, and 68% of the region's Gross Domestic Product is generated in those counties.*



Storm Surge: *Higher sea levels can expand the reach of storm-related flooding and make storms more damaging. On our current path, additional projected sea level rise will likely increase average annual property losses from hurricanes and other coastal storms for the region by $6 billion to $9 billion by 2100.*

Heat : *Increased heat will be especially severe in cities and metro regions with more than 1 million people, where the high concentration of concrete and lack of natural cooling systems like streams and forests create an "urban heat island" effect that can raise average temperatures by as much as 5.4°F during the day and 22°F in the evening over the surrounding rural areas.*

Data Source: Rhodium Group

NORTHEAST

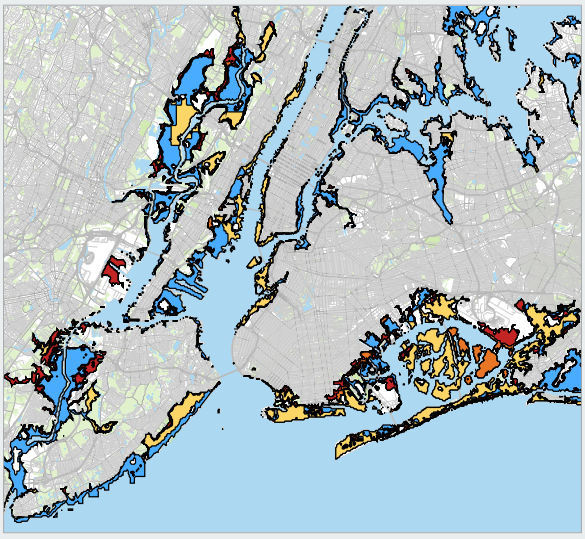
level rise by end of this century. North of New York City, the rise is slightly smaller: Boston will likely experience 2 feet to 4 feet by 2100, and Portland is likely to experience a rise of 1.7 feet to 3.8 feet in the same period.

Just looking at the simple rise in sea levels masks the impact these higher levels can have during a major storm. Sea level rise that had already occurred over the past century exacerbated storm surge during Hurricane Sandy, expanding the reach of the storm-related flooding and making the storm more costly. Our research shows that, if we continue on our current path, additional projected sea level rise will likely increase average annual property losses from hurricanes and other coastal storms by $6 billion to $9 billion over the course of the century. Potential changes in hurricane activity, also caused by atmospheric warming, would raise these estimates to $11 billion to $17 billion—a 2-to-3-fold increase from current levels.

The Northeast will also suffer from increased heat, especially because so many of the region's residents live in cities that have higher temperatures due to the so-called "heat island effect." In cities and metro regions with more than 1 million people, the high concentration of concrete and lack of natural cooling systems like streams and forests can raise average temperatures by as much as 5.4°F during the day and 22°F in the evening over the surrounding rural areas. [15]

Figure 4: Expected Flooding From a 1-in-100 Year Storm

New York City



Current expected flooding from 1-in-100 year storm

Increase by 2030 | Increase by 2050 | Increase by 2100

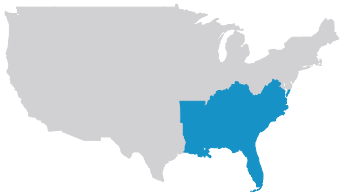
Source: Risk Management Soultions (RMS)

NORTHEAST

Right now, the Northeast is actually rather temperate in the summer, with only 2.6 days over 95°F on average each year—a temperature we refer to throughout our research as "extremely hot." By mid-century, the average resident in the Northeast will likely see between 4.7 and 16 additional extremely hot days; by late century this range will likely jump to between 15 and 57 additional extremely hot days, or up to two additional months of extreme heat. As we discuss further in the Southeast section below, these increasingly hot summers will have serious negative effects on health, mortality, and labor productivity.

A man tries to cool down during a Philadelphia heat wave

SOUTHEAST



Like the Northeast, the Southeastern U.S. has many coastal communities, though in this region only 36% of residents live in coastal counties, with 33% of GDP coming from those counties.

However, **sea level rise could seriously threaten the Southeast's coastal infrastructure,** given that some of the regions major cities (e.g., New Orleans) are at or below sea level while others (e.g., Miami) are built on porous limestone that allows water inundation even in the presence of a sea wall. Much of the region's critical infrastructure—including roads, rails, ports, airports, and oil and gas facilities—also sits at low elevations.

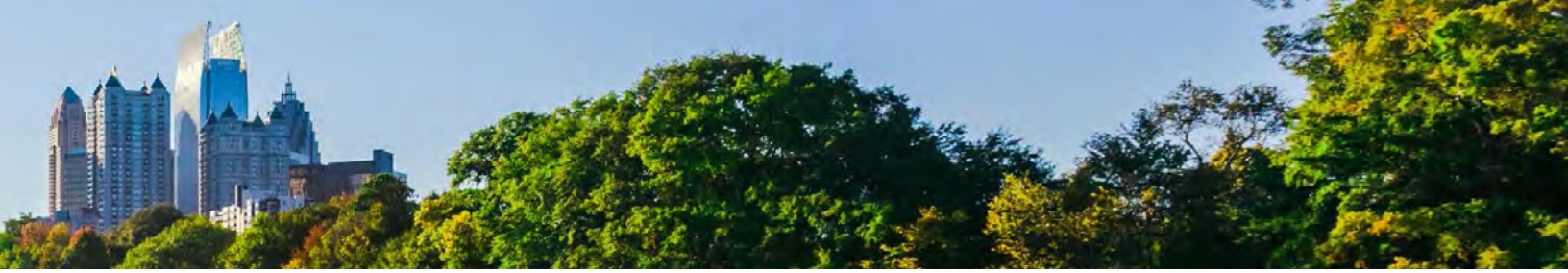
Our research shows a significant risk to this region from sea level rise. On our current path, by mid-century, mean sea level at Norfolk, Virginia—home to the nation's largest naval base—will likely rise between 1.1 feet and 1.7 feet, and will rise 2.5 feet to 4.4 feet by the end of century. However, there is a 1-in-100 chance that Norfolk could see sea level rise of more than 7.2 feet by the end of the century (Figure 7).

In Florida, because of the porous limestone on which the major southern cities are built, even modest sea level rise comes at a significant economic cost. Under current projections, between $15 billion and $23 billion of existing property will likely be underwater by 2050, a number that grows to between $53 billion and $208 billion by the end of the century. There is a 1-in-20 chance that more than $346 billion in current Florida property will be underwater by the end of this century, and a 1-in-100 chance that more than $681 billion in property will be below mean sea levels. An additional $240 billion in property will likely be at risk during high tide that is not at risk today.

A resident kayaks down a flooded street of Norfolk, Va.

As in the Northeast, greater flooding during hurricanes and other coastal storms, plus potential changes in hurricane activity, pose even greater and more immediate economic risks than mean sea level rise.

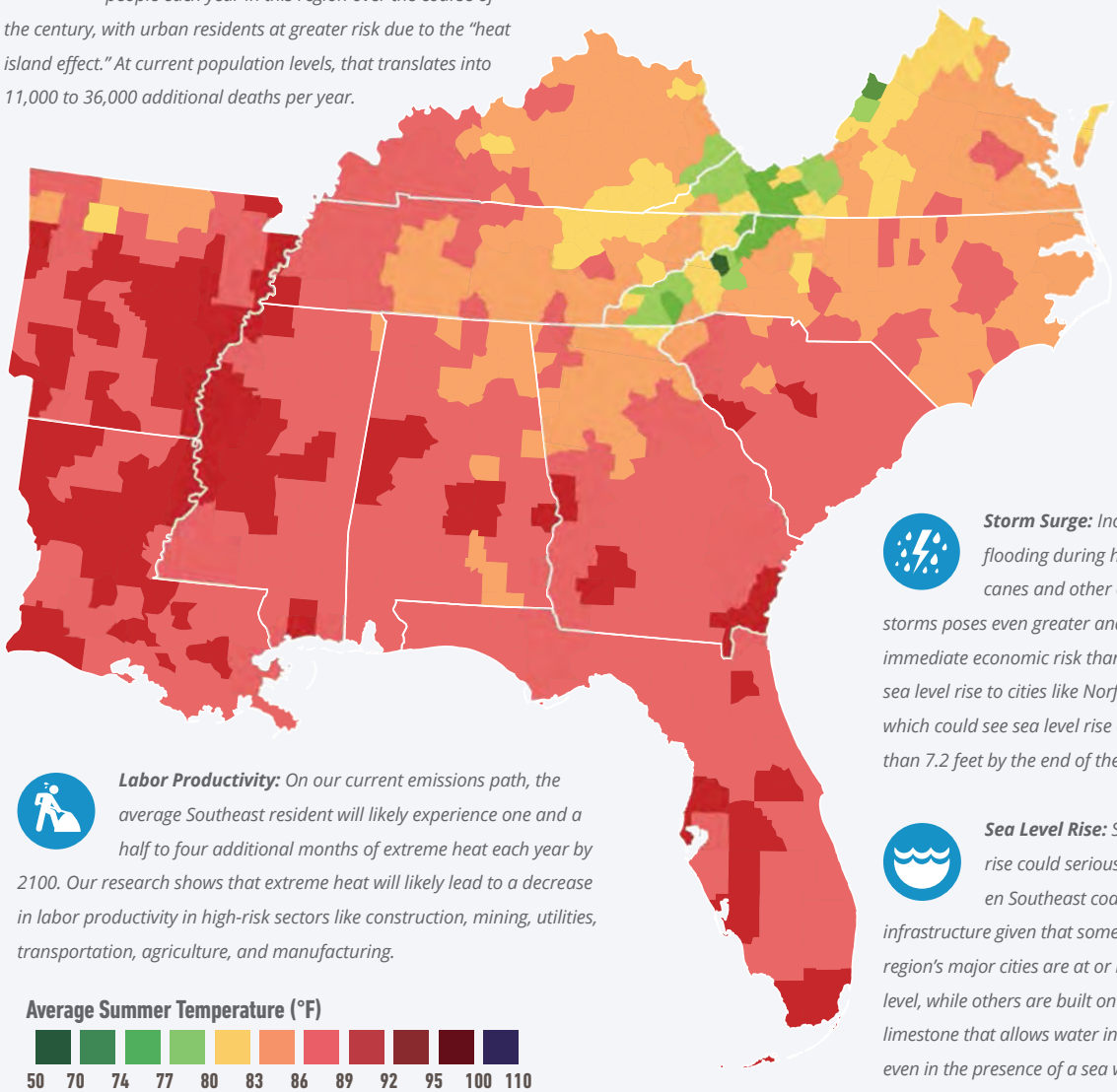
The Southeast will also likely be hit hardest by heat impacts. Over the past 30 years, the average resident of this region has experienced about 9 days per year at 95°F



SOUTHEAST

SOUTHEAST: AVERAGE SUMMER TEMPERATURE BY 2100 & KEY IMPACTS

Heat-Related Mortality: *Heat-related mortality will likely cause 15 to 21 additional deaths per 100,000 people each year in this region over the course of the century, with urban residents at greater risk due to the "heat island effect." At current population levels, that translates into 11,000 to 36,000 additional deaths per year.*



Storm Surge: *Increased flooding during hurricanes and other coastal storms poses even greater and more immediate economic risk than mean sea level rise to cities like Norfolk, which could see sea level rise of more than 7.2 feet by the end of the century.*

Labor Productivity: *On our current emissions path, the average Southeast resident will likely experience one and a half to four additional months of extreme heat each year by 2100. Our research shows that extreme heat will likely lead to a decrease in labor productivity in high-risk sectors like construction, mining, utilities, transportation, agriculture, and manufacturing.*

Sea Level Rise: *Sea level rise could seriously threaten Southeast coastal infrastructure given that some of the region's major cities are at or below sea level, while others are built on porous limestone that allows water inundation even in the presence of a sea wall.*

Data Source: Rhodium Group

Figure 6: Mean Sea Level Rise in Miami by 2100

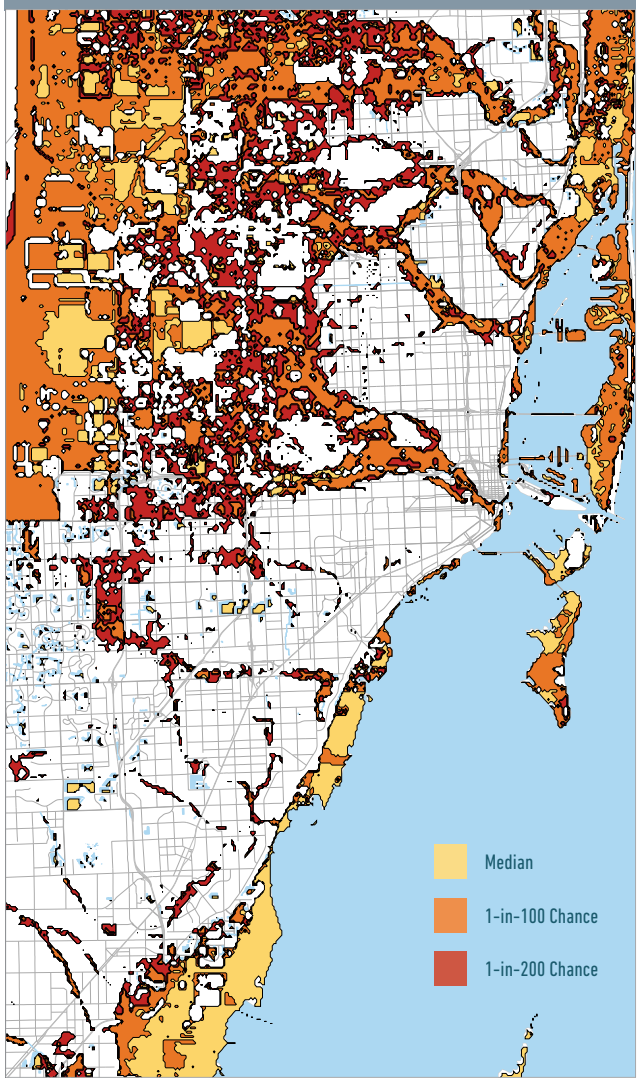
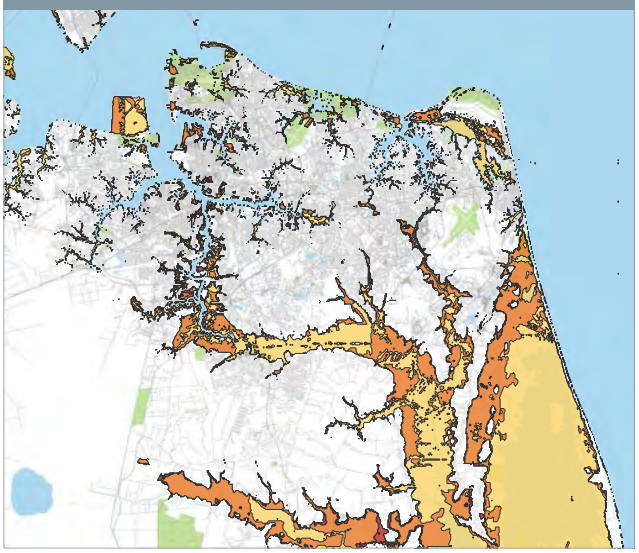


Figure 7: Mean Sea Level Rise in Norfolk by 2100

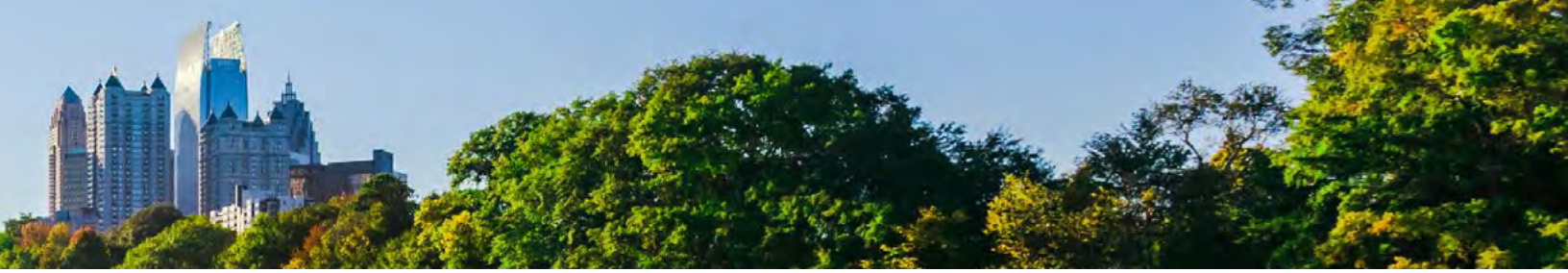


Source: RMS

or above. Looking forward, if we continue on our current emissions path, the average Southeast resident will likely experience an additional 17 to 53 extremely hot days per year by mid-century and an additional 47 to 115 days per year by the end of the century. That's one and a half to four additional months of extreme heat each year.

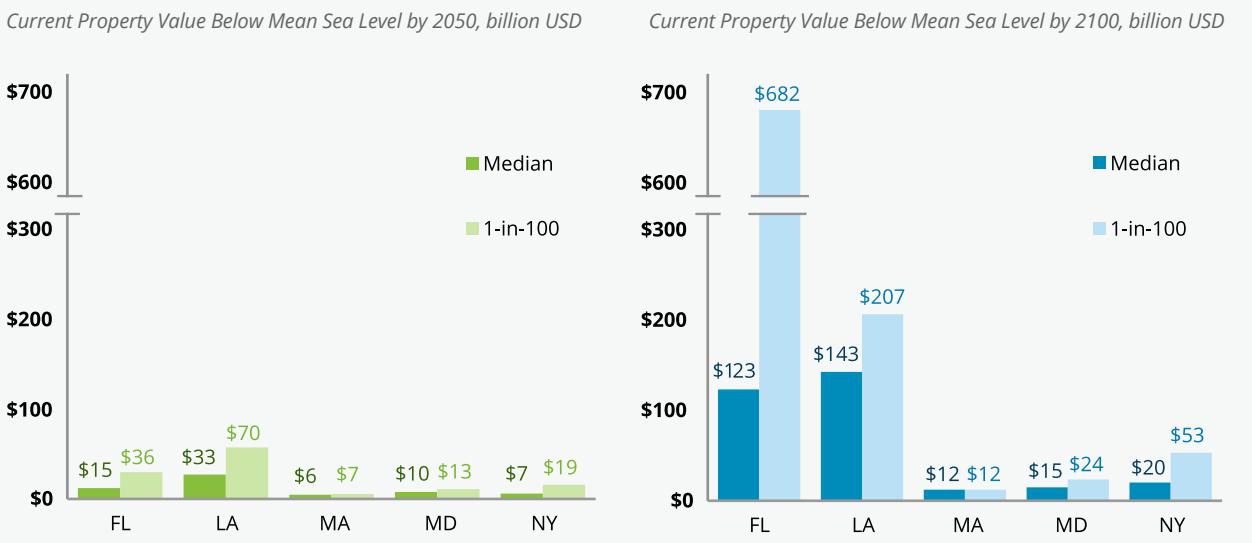
This kind of weather could have serious economic impacts: Our research shows a **decrease in labor productivity in high-risk sectors** like construction, mining, utilities, transportation, agriculture and manufacturing of up to 3.2% by the end of the century in this region, and a smaller but still noticeable impact on labor productivity in low-risk sectors like retail trade and professional services.

We are also likely to see an additional 15 to 21 deaths per 100,000 people every year in this region over the course of the century due to **increases in heat-related mortality**, with urban residents at greater risk due to the heat island effect. At the current population of the Southeast, that translates into 11,000 to 36,000 additional deaths per year.



SOUTHEAST

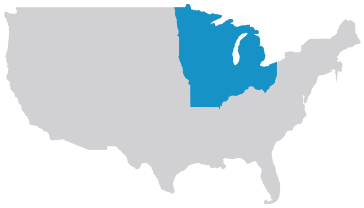
Figure 8: Value of State Property Below Mean Sea Level



Data Source: Rhodium Group

As Risk Committee member Dr. Alfred Sommer has pointed out, extreme heat will have a major impact on the capacity of local hospitals: "We just don't have the surge capacity left in the medical system anymore. . . . If these [impacts] occur in rural areas you're particularly in trouble."[16] He goes on to note that in Chicago during the 1995 heat wave, local officials "didn't even have a place to properly store [bodies from] the 700 deaths . . . that occurred over a small number of days." [17]

MIDWEST



The upper Midwest economy is dominated by commodity agriculture, with some of the most intensive corn, soybean, and wheat growing in the world.

Overall, the agricultural industry in this region includes more than 520,000 farms valued at $135.6 billion per year as of 2012, and the region accounts for 65% of national production of corn and soybeans alone.[18] For the Midwest, commodity agriculture is a crucial business, and the health and productivity of the agricultural sector is inextricably intertwined with climate conditions. Our research shows that under the "business as usual" scenario and assuming no significant adaptation by farmers, some states in the region, like Missouri and Illinois, face up to a 15% likely average yield loss in the next 5 to 25 years, and up to a 73% likely average yield loss by the end of the century. Assuming no adaptation, the region as a whole faces likely yield declines of up to 19% by mid-century and 63% by the end of the century.

Yet while the agricultural industry will clearly be affected by climate change, it is also probably the best equipped to manage these risks. Farmers have always adapted to changing weather and climate conditions, with adaptation and flexibility built into their business models. Armed with the right information, Midwest farmers can, and will, mitigate some of these impacts through double- and triple-cropping, seed modification, crop switching

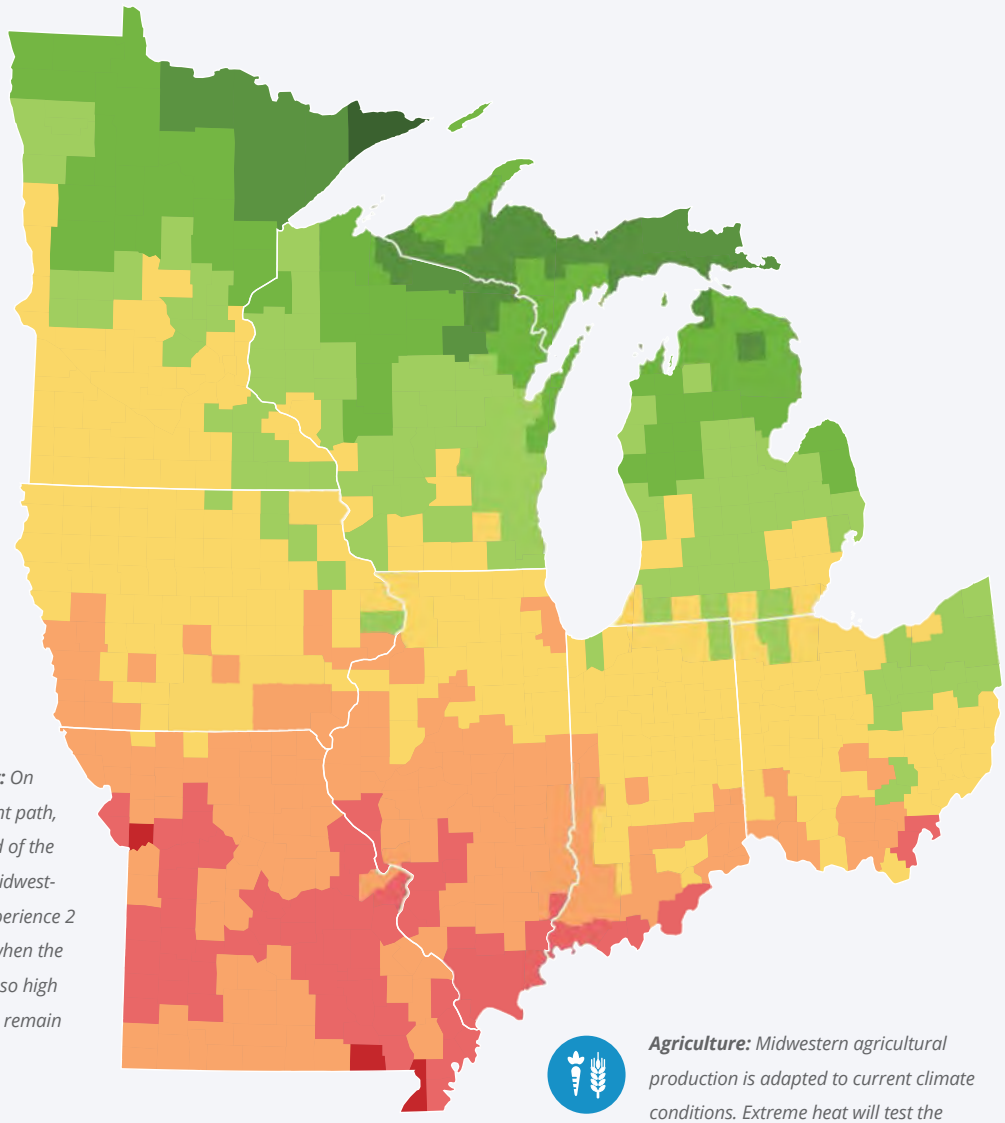
A farmer surveys his dry pond bed in Ashley, Illinois

and other adaptive practices. In many cases, crop production will likely shift from the Midwest to the Upper Great Plains, Northwest, and Canada, helping to keep the U.S. and global food system well supplied. However, this shift could put individual Midwest farmers and farm communities at risk if production moves to cooler climates.

The projected increase in Midwest surface air temperatures won't just affect the health of the region's crops; it will also put the region's residents at risk. Over the past 40 years, the Midwest experienced only 2.7 days on average over 95°F. If we stay on our current climate path, the average Midwest resident will likely experience an additional 7 to 26 days above 95°F each year by mid-century, and 20 to 75 additional extreme-heat

MIDWEST

MIDWEST: AVERAGE SUMMER TEMPERATURE BY 2100 & KEY IMPACTS



Mortality: *On our current path, by the end of the century, the average Midwesterner can expect to experience 2 days in a typical year when the heat and humidity are so high that it will be unsafe to remain outdoors.*

Average Summer Temperature (°F)

50 70 74 77 80 83 86 89 92 95 100 110

Agriculture: *Midwestern agricultural production is adapted to current climate conditions. Extreme heat will test the limits of crop innovations, and may result in reduced crop yields—unless farmers employ new adaptive practices.*

Data Source: Rhodium Group

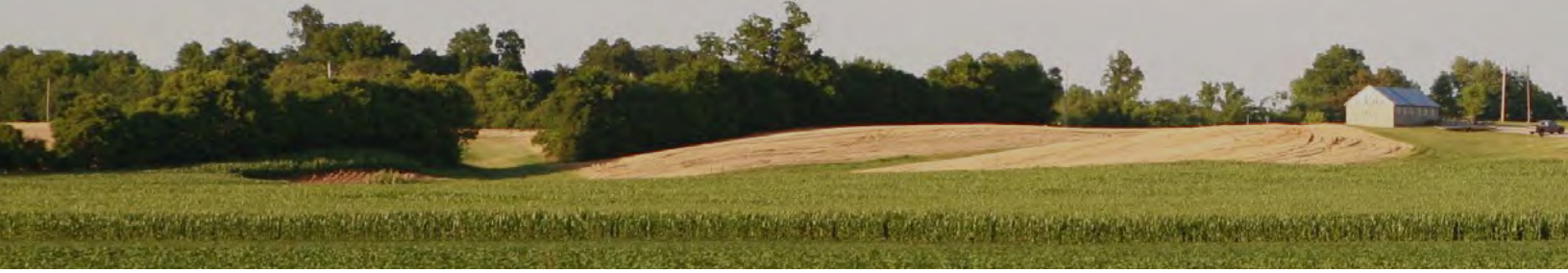
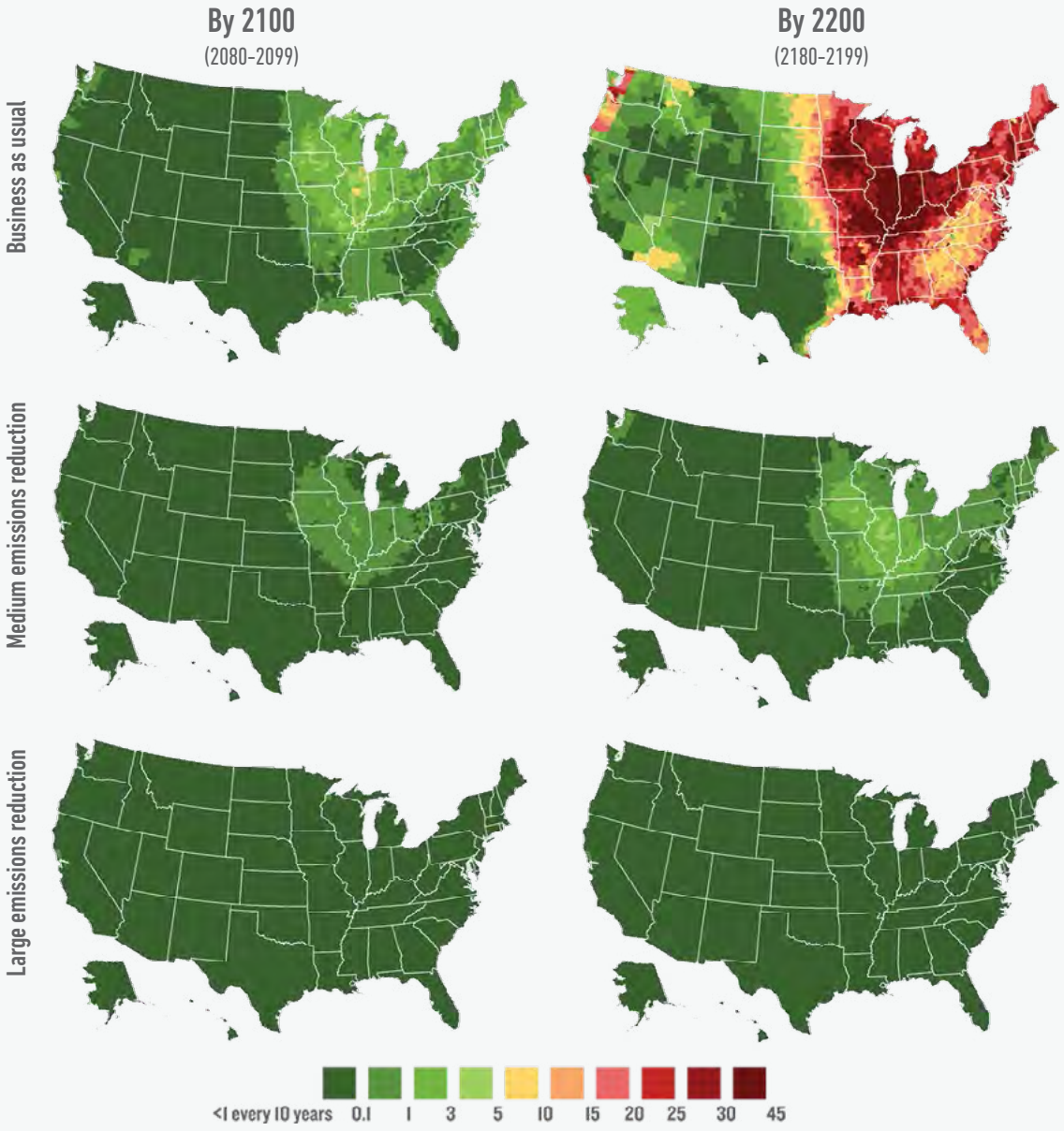


Figure 9: Humid Heat Stroke Index

Days per year when the heat and humidity could be so high that it will be unsafe for humans to remain outdoors (HHSI >92°F)



Data Source: Rhodium Group

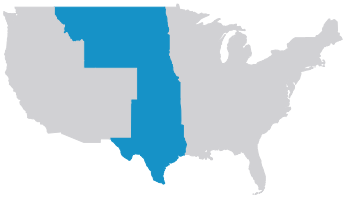
MIDWEST

days—potentially more than 2 additional months per year of extreme heat—by the end of the century. On the other hand, the region will also experience fewer winter days with temperatures below freezing.

But the real story in this region is the combined impact of heat and humidity, which we measure using the **Humid Heat Stroke Index**, or **HHSI**. The human body's capacity to cool down in the hottest weather depends on our ability to sweat, and to have that sweat evaporate on our skin. Sweat keeps the skin temperature below 95°F, which is required for our core temperature to stay around 98.6°F. But if the outside temperature is a combination of very hot and very humid—if it reaches a HHSI of about 95°F—our sweat cannot evaporate, and our core body temperature can rise until we actually collapse from heat stroke. Even at an HHSI of 92°F, core body temperatures can get close to 104°F, which is the body's absolute limit.

To date, the U.S. has never experienced heat-plus-humidity at this scale. The closest this country has come was in 1995 in Appleton, Wisconsin, when the HHSI hit 92°F. (At the time, the outside temperature was 101°F and the dew point was 90°F.) The only place in the world that has ever reached the unbearable HHSI of 95°F was Dhahran, Saudi Arabia, in 2003 (outside temperature of 108°F, dew point of 95°F). Our research shows that if we continue on our current path, the average Midwesterner could see an HHSI at the dangerous level of 95°F two days every year by late century, and that by the middle of the next century, she or he can expect to experience 20 full days in a typical year of HHSI over 95°F, during which it will be functionally impossible to be outdoors.

GREAT PLAINS



The Great Plains region stretches from the far north (Montana) to the far South (Texas). Climate impacts will be felt very differently in the northern and southern parts of this region.

In the southern states of the Great Plains region (Texas, Oklahoma, and Kansas), our research shows an increase in extremely hot days. The average resident of these states experienced 35 days per year over 95°F in the past 30 years. This number will likely increase by 26 to 56 additional extremely hot days by mid-century and 56 to 108 days per year by the end of the century—for a total of between three and four months of additional extreme hot days per year.

At the same time, the northern parts of the region will likely see a significant *decrease* in extremely cold days: from the average of 159 days per year of below-freezing weather over the past 30 years, to between 117 and 143 freezing days at mid-century, and between 79 and 122 freezing days by the end of the century.

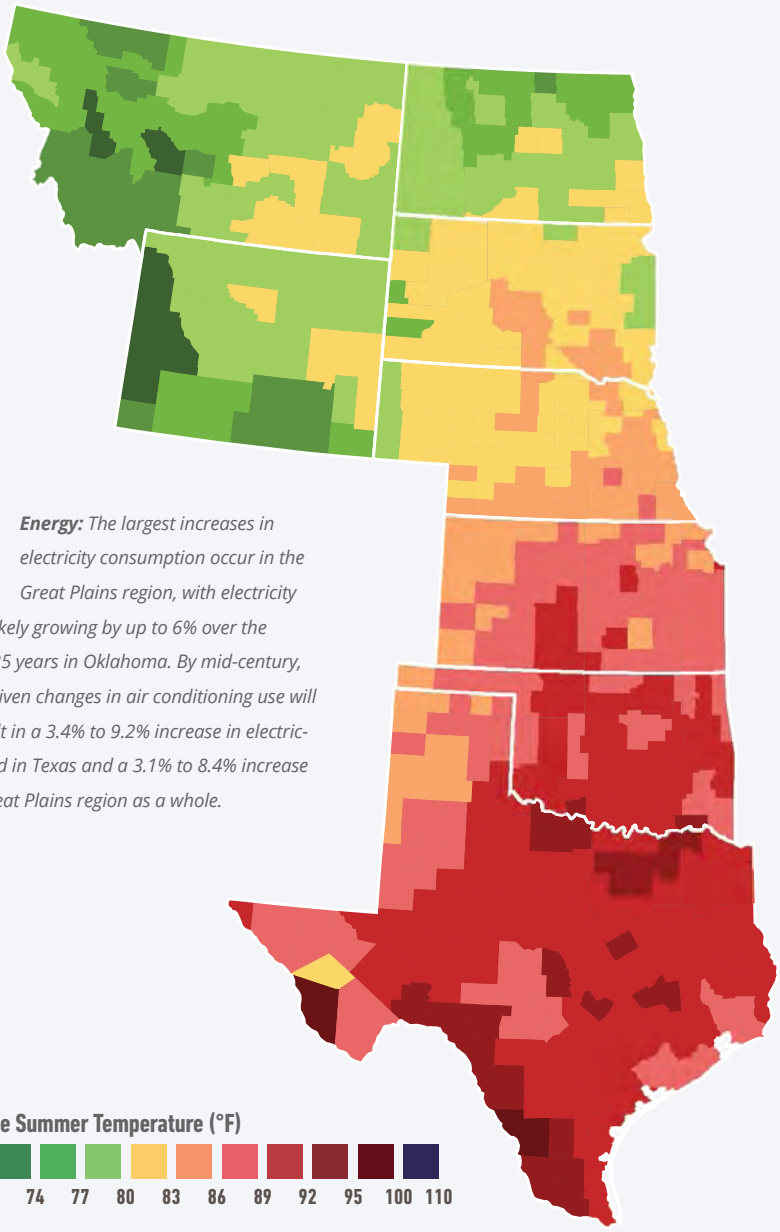
The southern and coastal parts of this region will also experience the **sea level rise impacts on coastal communities** that we've already discussed. In Texas, for instance, where about one-third of the state's GDP is generated in coastal counties, sea levels will likely rise by 1.5 to 2 feet by mid-century and 3.2 to 4.9 feet by the end of the century, with a 1-in-100 chance of a 7.0-foot rise.

Though the north and south sub-regions of the Great Plains have starkly different climates, all the states in this region rely on two important climate-sensitive industries: agriculture and energy.

Altogether, 80% of the region is devoted to cropland, pastures, and range land, which produce $92 billion in agricultural products each year. The story for the region's agricultural sector is mixed: The more southern states may see declining crop yields as temperatures continue to rise, while the northern states may actually see yield gains, though this will depend on a number of factors, including water availability. (See the Southwest section for a more detailed discussion of this factor.)

GREAT PLAINS

GREAT PLAINS: AVERAGE SUMMER TEMPERATURE BY 2100 & KEY IMPACTS



Energy: *The largest increases in electricity consumption occur in the Great Plains region, with electricity demand likely growing by up to 6% over the next 5 to 25 years in Oklahoma. By mid-century, climate-driven changes in air conditioning use will likely result in a 3.4% to 9.2% increase in electricity demand in Texas and a 3.1% to 8.4% increase for the Great Plains region as a whole.*

Agriculture: *The southernmost states may see declining crop yields as temperatures continue to rise, while the northern states may see yield gains.*

Sea Level Rise: *The southern and coastal parts of this region will experience sea level rise impacts on coastal communities. In Texas, sea levels will likely rise by 3.2 to 4.9 feet by 2100.*

Data Source: Rhodium Group

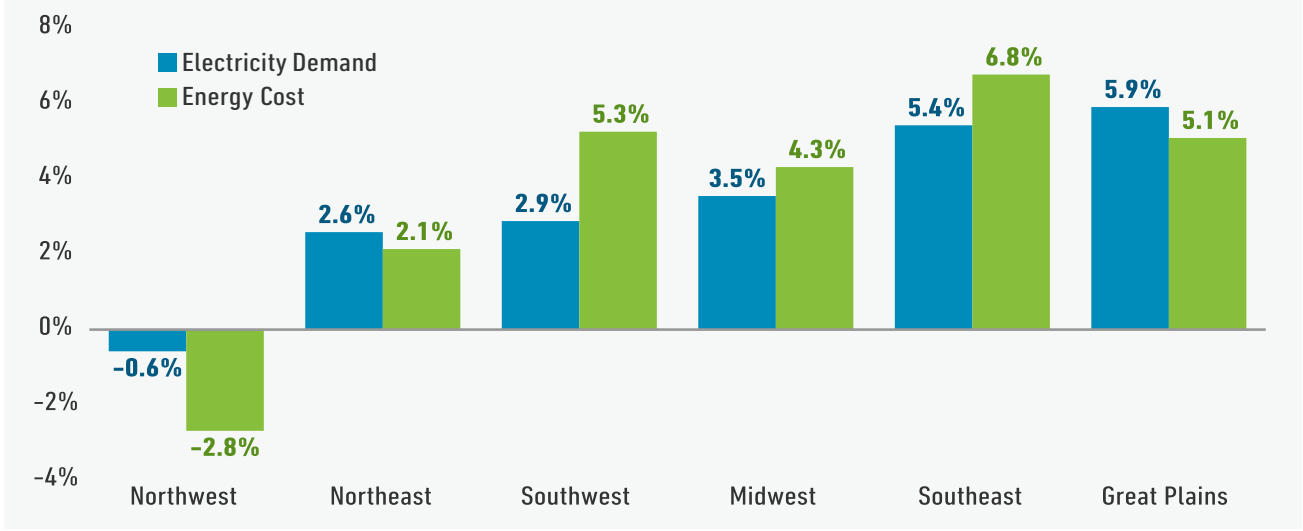
GREAT PLAINS

At the same time, the region is a major energy producer for the nation, making **climate impacts on the energy sector** particularly important for this area. Texas and Wyoming alone produce half of U.S. energy (primarily from crude oil and natural gas in Texas and coal in Wyoming), and North Dakota has recently become a major oil and gas producer. Power generation facilities in the region currently meet about 17% of the nation's overall electricity needs.[19]

If we stay on our current path, our research shows a significant increase in demand for air conditioning over the course of the century which, when combined with other heat-related impacts such as reductions in power generation and in transmission efficiency and reliability, could place a considerable burden on the electricity power sector. As soon as 5 to 25 years from now, our research shows a 0.8% to 2.2% likely increase in nation-wide electricity consumption. The country will likely see a roughly corresponding decline in demand for heating, as temperatures warm up in the northern states, but the switch from natural gas and fuel oil-driven heating demand to electricity powered cooling demand has significant implications for the U.S. energy system.

The largest increases in electricity consumption occur in the Great Plains region, with likely electricity demand growth in Texas and Oklahoma of up to 5% and 6% respectively over the next 5 to 25 years. By mid-century, climate-driven changes in air conditioning will likely result in a 3.4% to 9.2% increase in electricity demand in Texas and a 3.1% to 8.4% increase for the Great Plains region as a whole.

Figure 10: Change in Electricity Demand and Energy Costs by Region, Mid-Century (2040-2059)



Data Source: Rhodium Group

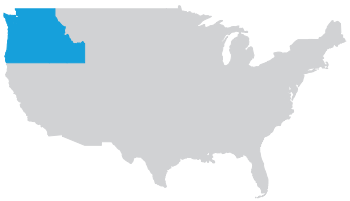
GREAT PLAINS

Shipping cranes at the Port of Houston

Most of this increase will occur during times of the day when electricity consumption is already high. Meeting higher peak demand will likely require the construction of up to 95 GW of additional power generation capacity over the next 5 to 25 years, the rough equivalent of 200 average-size coal or natural gas power plants. Constructing these new power-generation facilities will, in turn, raise residential and commercial energy prices. Our research concludes that climate-driven changes in heating and cooling will likely increase annual residential and commercial energy costs nationally by $474 million to $12 billion over the next 5 to 25 years and $8.5 billion to $30 billion by the middle of the century.

All of this could have a significant impact on the economy of the Great Plains. In addition, many of the region's current energy-production facilities—from power plants to oil and gas platforms—are at risk from climate-driven increases in storm surge and potential changes in hurricane activity. If these facilities are flooded, the region will lose electricity and energy resources just as the country's need for them is growing.

NORTHWEST



The Pacific Northwest is a good example of the general truth that similar climate impacts may be felt differently from one region to another.

For example, by mid-century this area will have fewer additional extremely hot days than, say, the Southeast—but the average Northwest resident will likely go from experiencing only 5 days of 95°F or warmer temperatures per year on average for the past 30 years to an additional 7 to 15 extremely hot days by mid-century, and to an additional 18 to 42 extremely hot days by the end of the century. This represents an increase of *3 to 8 times* the number of hot days for the region per year, which is a significant change from historic norms.

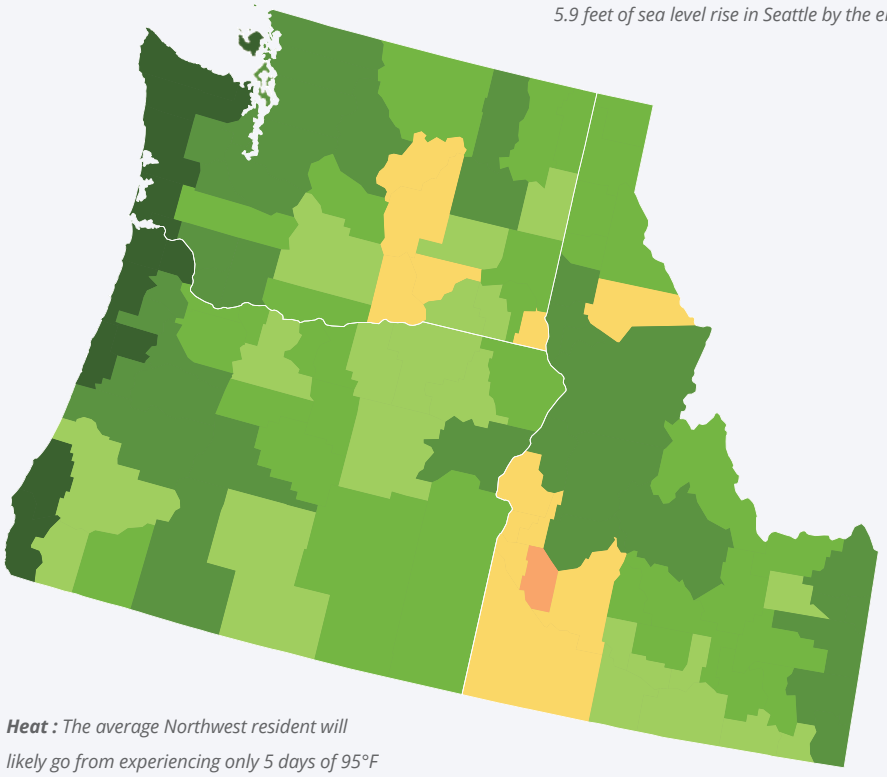
This region is also coastal, but the extent of expected sea level rise here is more varied than the east coast. Because the area is relatively close to the Alaskan glaciers, the Earth's gravitational field may lead to the ice melt in Alaska actually lowering sea levels off Washington and Oregon. At the same time, West Antarctic melt may lead to higher sea level rise in the Northwest over the long term. This latter effect is captured in our analysis of the "tail risk" of sea level rise in the Northwest. Overall, our research shows that if we stay on our current path, sea level at Seattle will likely rise by 0.6 to 1.0 foot between 2000 and 2050 and by 1.6 to 3.0 feet between 2000 and 2100. Looking out to the tail risks, though, there is a 1-in-100 chance of more than 5.9 feet of sea level rise by 2100 in Seattle.

The economy of the Northwest is dependent on its coastlines, but it is also heavily dependent on its forests. Oregon and Washington are the number one and two softwood-producing states in the nation, respectively;[20] these two states plus Idaho produce more than $11 billion in primary wood product sales.[21] Our review of existing research suggests the Northwest's forests will experience significant potential impacts from climate change, in particular from wildfire—due to both increased drought and to wood damage from pests surviving warmer winters. One study we reviewed found that if temperatures rise 3.2°F by mid-century, this could lead to 54% increase in the annual area burned in the western U.S.[22] The same study found that the forests of the Pacific Northwest and Rocky Mountains will likely experience the greatest increases in annual burn area (78% and 175%, respectively).

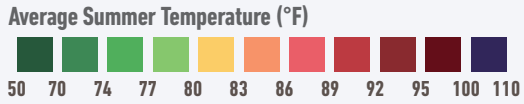
NORTHWEST

NORTHWEST: AVERAGE SUMMER TEMPERATURE BY 2100 & KEY IMPACTS

Sea Level Rise: *If we stay on our current path, sea level at Seattle will likely rise by 0.6 to 1.0 foot by mid-century and by 1.9 to 3.4 feet by 2100. Looking out to the tail risks, though, there is a 1-in-100 chance of up to 5.9 feet of sea level rise in Seattle by the end of the century.*

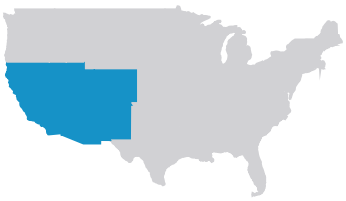


Heat : *The average Northwest resident will likely go from experiencing only 5 days of 95°F or warmer temperatures per year on average for the past 30 years to an additional 18 to 42 extremely hot days by the end of the century.*



Data Source: Rhodium Group

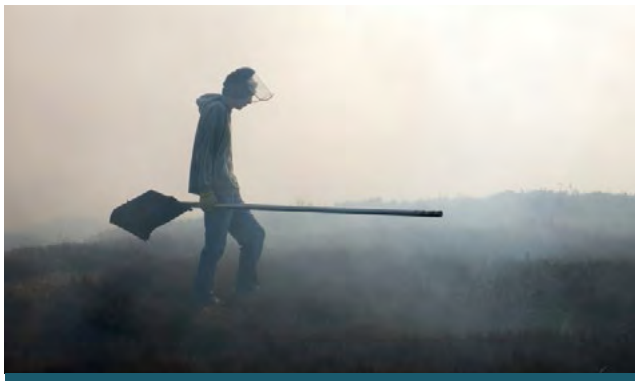
SOUTHWEST



The Southwest region includes the traditional Southwest states—Arizona, Colorado, Nevada, New Mexico, Utah—and also California. As such, it is an extremely diverse region that in some ways serves as a microcosm of all the climate impacts we've discussed so far.

This region is already warm and dry—about 40% of this area is covered by desert[23]—and is likely to become more so in the coming decades. Over the past 30 years, the average Southwest resident experienced 40 days per year of temperatures of 95°F or more. If we continue on our current path, by mid-century the average Southwest resident will likely see 13 to 28 additional extremely hot days. By the end of the century, this number will likely rise to an additional 33 to 70 days of extreme heat due to climate change. That translates to one to two additional months of days over 95°F each year within the lifetime of babies being born right now in this region—one of the fastest-growing in the United States.

Because it includes California, the Southwest is not just one big desert; it is also an extremely coastal region. Eighty-seven percent of all Californians live in coastal counties, and 80% of the state's GDP is derived from those counties. Along the coastline of San Diego, if we continue on our current path, sea level will likely rise by 0.7 to 1.2 feet before the middle of the century, and by 1.9 to 3.4 feet by the end of the century. But the real sea level risk in this region is in the tails. The California coastline is more exposed to sea level rise resulting from Antarctic melt than the global average, and there is a 1-in-100 chance that sea levels could rise by more than 6.3 feet by 2100 in San Diego.



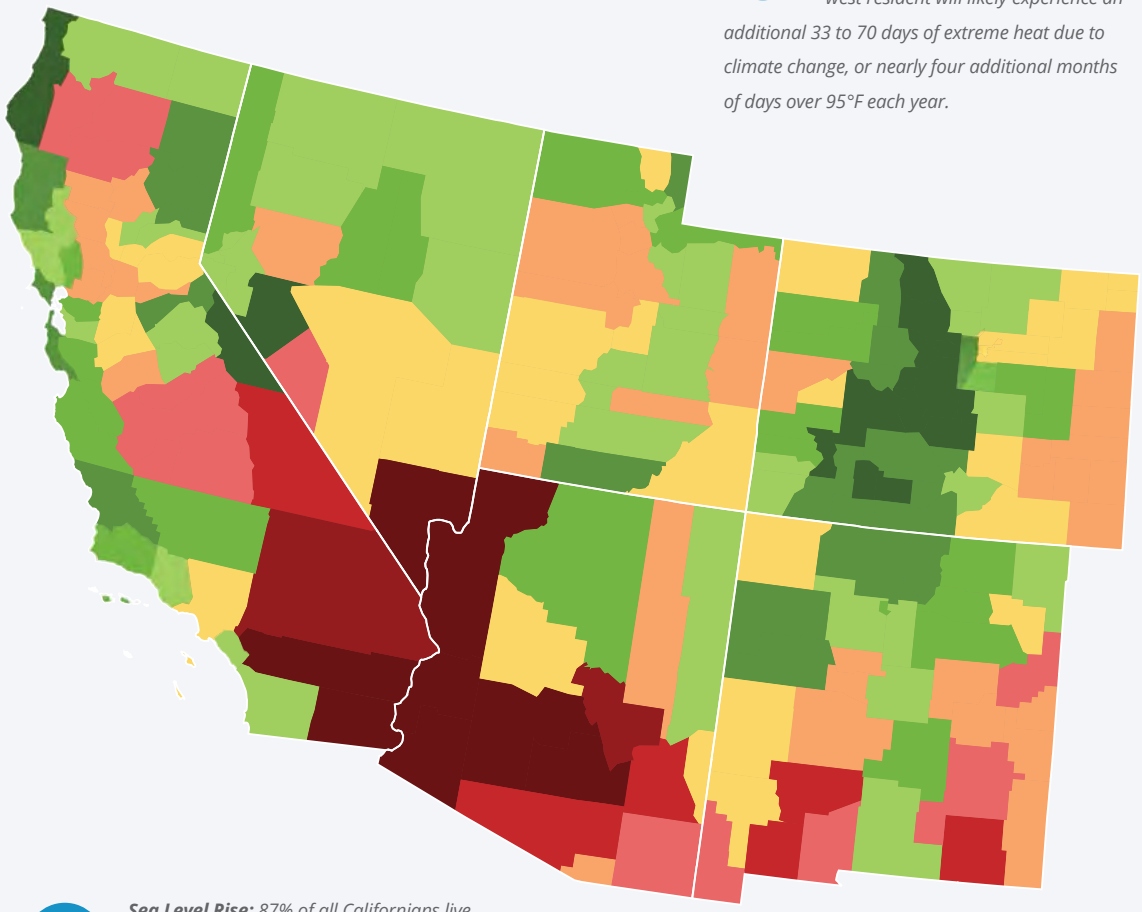
Wildland Firefighter

San Diego is of strategic importance to the U.S. military: The city is home to three Marine installations, including Marine Corps Base Camp Pendleton, three naval bases, and a Coast Guard station. Fortunately, the military is one of our country's leading institutions in terms of acknowledging the potential impact of climate risk on its installations here and throughout the U. S. The Department of Defense's 2010 Quadrennial Defense Review called for a climate impact assessment at all DOD's permanent installations, and several studies are already underway.[24]

SOUTHWEST

SOUTHWEST: AVERAGE SUMMER TEMPERATURE BY 2100 & KEY IMPACTS

Heat: *On our current path, by the end of the century, the average Southwest resident will likely experience an additional 33 to 70 days of extreme heat due to climate change, or nearly four additional months of days over 95°F each year.*



Sea Level Rise: *87% of all Californians live in coastal counties, and 80% of the state's GDP is derived from those counties. Along the coastline of San Diego, if we continue on our current path, sea level will likely rise by 1.9 to 3.4 feet by 2100.*

Average Summer Temperature (°F)

50 70 74 77 80 83 86 89 92 95 100 110

Data Source: Rhodium Group

SOUTHWEST

In part because of tectonic plate activity in California, sea level rise will vary across the state: Los Angeles (1.5 to 2.9 feet by 2100), Santa Monica (1.7 to 3.1 feet by 2100), and San Francisco (1.8 to 3.2 feet by 2100) will likely see lower rise than San Diego.

While extreme heat days in the Midwest and Southeast will likely be coupled with high humidity, here in the Southwest the days will likely be hot and dry, increasing the potential of wildfires and drying up water sources. While we did not quantify the impact of climate change on either forestry or water availability, these are significant climate risks in the Southwest region, and both are ripe for further analysis.

As the Southwest climate heats up, the region is likely to see significantly less snow in the mountains, leading to decreases in spring runoff especially in California and the Southern Rockies. Extreme heat may also lead to higher evaporation of existing reservoirs. This translates into less available groundwater for critical industries such as agriculture, as well as for simple drinking and bathing. Even as temperatures rise, increased energy demand from air conditioning will likely lead to increased water demand, since electricity generation is heavily water-dependent. Decreased water availability is also likely to be the most significant impact on this region's agricultural industries, which tend to be non-commodity crops (tree nuts, fruits, etc.) and therefore are not included in our quantitative analysis of the agricultural sector.

> *A broad range of issues impact real estate, construction, and urban development. Obviously coastal inundation is one of those. Another is the implication of extreme weather events even within the internal parts of the country. . . . Some of the most water scarce areas of the country are due to get less precipitation. Areas that are dry are going to get drier. And that has immense implications for cites in the west.*
>
> **— Risk Committee member Henry Cisneros**[25]

SOUTHWEST

San Diego, California

ALASKA

Alaska is ground zero for U.S. climate impacts. The state relies heavily on three climate-sensitive commodities: oil and gas, minerals, and seafood.

More than 80% of the state's GDP comes from oil and gas production, and so increases in energy demand (as discussed above) will dramatically affect this region. Meanwhile, fisheries and tourism, the third and fourth largest contributors to the Alaska economy, depend on healthy oceans and coastal ecosystems.

Alaskan fisheries rely heavily on healthy oceans

Our research shows major climactic changes in Alaska over this century. If we continue on our current path, by mid-century Alaska's average temperature will likely rise to between 3.9°F to 8.0°F warmer than it has been over the past forty years. By the end of the century, temperatures will likely rise by 7.6°F to 16°F, but there is a 1-in-20 chance that they will rise even higher, by as much as 19°F. The bulk of this warming is likely to happen in the winter months, significantly decreasing the number of extremely cold days that Alaska now experiences. Up until 2010, Alaska experienced about 188 days per year below freezing; our current path will likely decrease these freezing days by 14% to 25% by mid-century, and by 30% to 50% by the end of this century.

The state is heavily coastal: 84% of Alaskans live in coastal counties, and 86% of the state's GDP comes from these counties. Sea level is variable around the state, due to the proximity of the glaciers and to shifting tectonic plates. As in the Pacific Northwest, the state may actually see sea levels go *down* over the course of this century: Our research shows that sea level at Juneau will likely fall by 1.6 to 1.9 feet between 2000 and 2050 and by 2.4 to 3.5 feet between 2000 and 2100. On the other hand, Anchorage will likely experience between a 0.6 feet sea level fall and a 1.2 feet sea level rise by the end of the century, with a 1-in-100 chance of more than a 4.0 foot rise. Prudhoe Bay is likely to experience 2.1 feet to 3.8 feet of sea level rise by 2100, with a 1-in-100 chance of a 6.6 foot rise.

HAWAII

As Alaska is at the center of climate impacts from melting ice, Hawaii is at the center of impacts from sea level rise. This state is 100% coastal in both its population and GDP.

Hawaii is expected to get significantly warmer: On our current path, by mid-century average temperatures will likely be between 1.6°F to 3.6°F warmer than temperatures over the past 40 years. By the end of the century, temperatures will likely increase between 3.7 and 7.7°F. There is also a small but not insignificant chance that Hawaii's average temperatures could rise as much as 9.4°F by the end of the century.

Sea level rise in Hawaii is greater than the global average, and the extreme dependence of this state on the coasts will only intensify this impact. If we continue on our current path, sea level rise at Honolulu is likely 0.8 inches to 1.2 feet greater by mid-century, and 2.1 to 3.8 feet by the end of the century. Looking out at the 1-in-100 tail risk, sea level at Honolulu could rise by more than 6.9 feet by 2100.

Hawaii cannot reasonably be looked at as a stand-alone region, however: This state imports the vast majority of its food and energy, and is interdependent with the rest of the U. S. as well as the rest of the world. The recent tsunami in Japan and typhoon in the Philippines have awakened many businesses to the impact of a changing climate on global supply chains,[26] and ultra-dependent regions like Hawaii are by necessity very sensitive to these realities. Changing agricultural yields on the mainland may have a significant effect on Hawaii in terms of food cost and availability. Similarly, higher energy costs in the continental U.S. are likely to drive the cost of imported energy even higher for Hawaii. The state is pushing forward to diversify its energy resources and rely more on domestic renewable sources; however, most of these installations are along the vulnerable coastlines.

"I think we have to begin by recognizing the reality and severity of this threat to our economies, both United States and globally, and really to life on earth more broadly as we know it. We also have to recognize that this problem needs to be dealt with now. We cannot wait because greenhouse gases in the atmosphere, once they're there, remain there for centuries so that every year is greater and more severe in terms of greenhouse gas emissions cumulatively than had been the case the year before."

— Risk Committee member Robert E. Rubin[27]

FROM RISK ASSESSMENT TO RISK MANAGEMENT: NEXT STEPS

If we were told—in any sphere—that we had at least a 90% chance of averting a disaster through changes we ourselves could make, wouldn't we take action?

— Risk Committee member Olympia Snowe[28]

Taking a classic risk assessment approach to climate change in the U.S. leads to the inescapable conclusion that if we continue on our current climate path, the nation faces multiple risks across every region.

But risk assessment is not just about identifying risks and leaving it at that. Our research also shows that if we act today to move onto a different path, we can still avoid many of the worst impacts of climate change, particularly those related to extreme heat. We are fully capable of managing climate risk, just as we manage risk in many other areas of our economy and national security—but only if we start to change our business and public policy decisions today.

The Risky Business Project was not designed to dictate a single response to climate risk. We know that there will be a diversity of responses to our analysis depending on the particular risk tolerance of individual business and policy actors, as well as their particular region or sector of the economy. But the Risk Committee does believe, based on this project's independent research and the significance of the climate risks it demonstrates, that it is time for all American business leaders and investors to get in the game and rise to the challenge of addressing climate change. The fact is that just as the investments and economic choices we made over the past several decades have increased our current vulnerability to climate change, so will the choices we make today determine what our nation looks like in 15 years, at mid-century, and by 2100.

In short, we have a choice whether we accept the climate risks laid out above or whether we get on another path. **This is not a problem for another day. The investments we make today—this week, this month, this year—will determine our economic future.**

NEXT STEPS

There are three general areas of action that can help to minimize the risks U.S. businesses currently face from climate change:

BUSINESS ADAPTATION

Changing everyday business practices to become more resilient.

Some of the climate impacts we analyzed are already being felt across the nation; indeed, some are already an unalterable part of our economic future. Rational business actors must adapt. The agricultural sector is on the front lines of climate adaptation. As Risk Committee member Greg Page has noted, "Farmers are innovators and consummate optimizers. . . . They persistently demonstrate the ability to adapt to changes in the environment and successfully adopt new technologies." [29] In coastal communities, too, private and public sector decision-makers are beginning to adapt to present climate impacts, building sea walls and changing building codes to recognize the reality of rising sea levels and increased storm surge.

But this adaptation may come at a price: Some farmers in Midwest counties, for instance, may suffer economic losses shifting to new crops (with required new equipment and expertise), if they can afford to shift at all. Meanwhile, coastal states and cities are being forced to adapt to climate realities without adequate financial support from the federal government. [30] These public sector adaptation costs will only grow as the private insurance industry continues its exodus from the business of insuring coastal real estate and the bond market begins to wake up to the vulnerability of key infrastructure investments to climate change. [31] As Donna Shalala, President of the University of Miami and Risk Committee member, has noted , "People in Florida really have thought through some of the consequences . . . to the extent that they can do some things themselves through their local governments, through the state, they certainly have stepped up to do many of those things . . . but it's not enough. This is going to take a national investment." [32]

INVESTOR ADAPTATION

Incorporating risk assessment into capital expenditures and balance sheets.

Another area where today's business investments have a direct relationship to tomorrow's climate impacts is in long-term capital expenditures, which will live well into the middle of the century and beyond. Today, ratings agencies are evaluating infrastructure projects with a multi-decade lifespan. Utilities are making investments in new power plants and pipelines, and signing long-term power purchase agreements that rely on those investments. And real estate investors are making multiple bets on residential and commercial properties. These investments must be evaluated in terms of the actual climate risk specific regions face as we approach the middle of this century. In 2010, recognizing this reality, the Securities and Exchange Commission (SEC) issued Interpretive Guidance on climate disclosure, giving companies some idea of how to consider their "material" risks from climate change; unfortunately, as of 2013, over 40% of companies listed on the Standard & Poor's 500 Index were still not voluntarily disclosing climate risks. [33]

NEXT STEPS

PUBLIC SECTOR RESPONSE

Instituting policies to mitigate and adapt to climate change.

Ultimately, climate change is not just an issue for specific sectors and regions: It is a global issue that demands an effective policy response from the U.S. According to the latest Intergovernmental Panel on Climate Change report, the world may have as little as 15 years to "keep planetary warming to a tolerable level," through an aggressive push to bring down carbon emissions. [34]

In the Risky Business Project, we focused primarily on modeling our current economic path and the attendant climate risks. Because this is the path we're now following as a nation, we need to better understand the potential risks it poses and decide how to respond to those risks—especially those that are already embedded in our economy because of decisions we made decades ago.

But the path we're on today does not have to be the path we choose to follow tomorrow. Our analysis also looks at alternate pathways that include investments in adaptation and policy efforts to mitigate climate change through lowering greenhouse gas emissions. These alternate pathways could significantly change the climate impacts we discuss above. For example, modest global emission reductions can avoid up to 80% of projected economic costs resulting from increased heat-related mortality and energy demand.

Our goal in this risk assessment is not to dictate those policy pathways. However, we do strongly urge the American business community to play an active role in the public discussion around climate mitigation and preparedness, which we believe is the single most effective way for businesses to decrease the risks we have identified in this project.

FROM RISK ASSESSMENT TO RISK MANAGEMENT: NEXT STEPS

With this project, we have attempted to provide a common language for how to think about climate risk—built upon a common language of risk that is already part of every serious business and investment decision we make today. If we have a common, serious, non-partisan language describing the risks our nation may face from climate change, we can use it as the springboard for a serious, non-partisan discussion of the potential actions we can take to reduce those risks.

CONCLUSION

When Risk Committee member George Shultz was serving as President Reagan's Secretary of State in 1987, he urged the President to take action on that decade's hotly-contested scientific issue: the ozone layer. As Shultz later said in an interview with *Scientific American*, "Rather than go and confront the people who were doubting it and have a big argument with them, we'd say to them: Look, there must be, in the back of your mind, at least a little doubt. You might be wrong, so let's all get together on an insurance policy."[35] That insurance policy became the Montreal Protocol on Substances that Deplete the Ozone Layer, an international treaty still in effect to this day.

Our goal with the Risky Business Project is not to confront the doubters. Rather, it is to bring American business and government—doubters and believers alike—together to look squarely at the potential risks posed by climate change, and to consider whether it's time to take out an insurance policy of our own.

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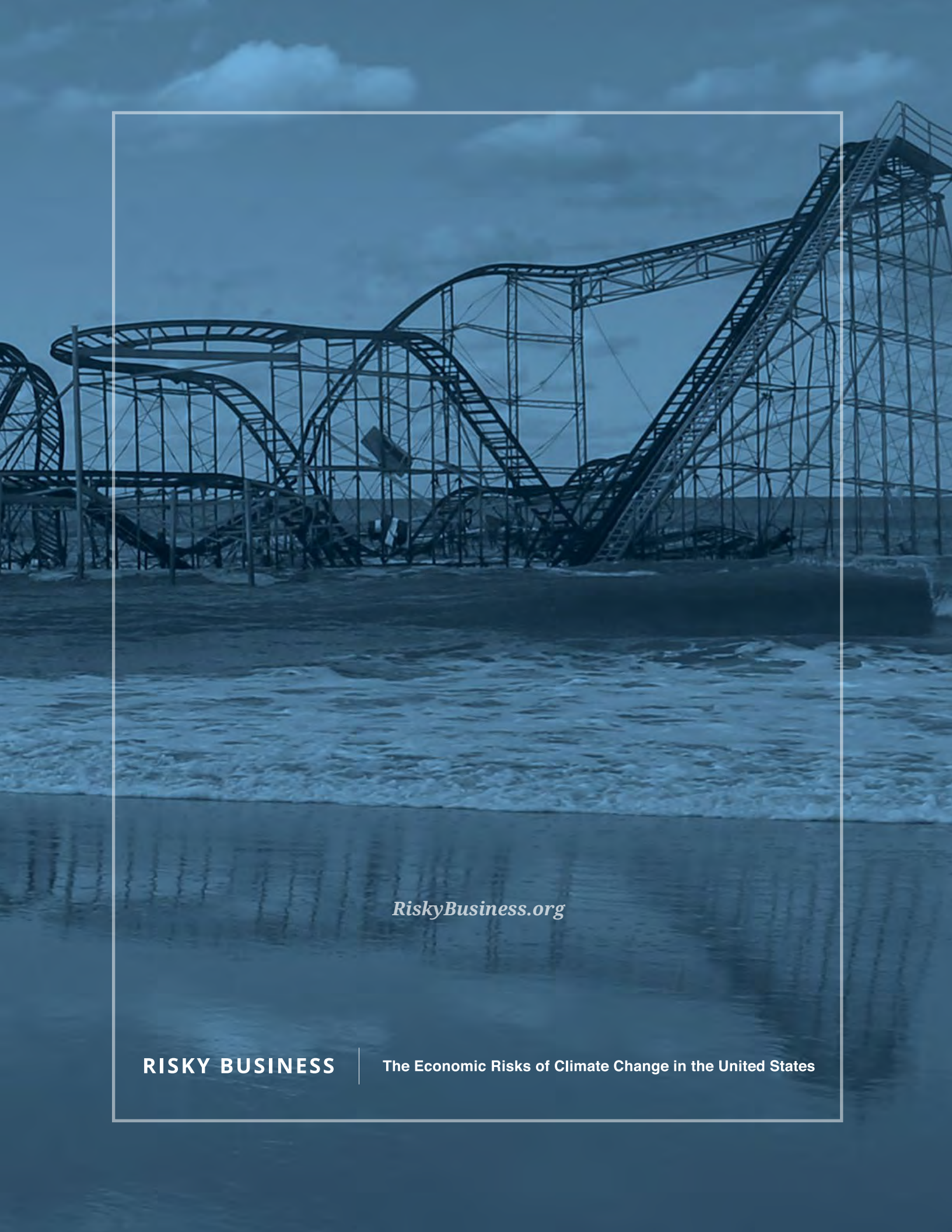

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The Economic Risks of Climate Change in the United States

ANALYSIS GROUP
ECONOMIC, FINANCIAL and STRATEGY CONSULTANTS

EPA's Clean Power Plan:
States' Tools for Reducing Costs and Increasing Benefits to Consumers

Analysis Group

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Acknowledgments

This report evaluates the Clean Power Plan – proposed by the U.S. Environmental Protection Agency on June 2, 2014 – from the perspective of how it might impact consumers. The report examines how states' plans to control carbon emissions may affect owners of affected power plants, other market participants in the electric industry, and, in turn, consumers of electricity. The paper examines one particular carbon-control program – the Northeast states' Regional Greenhouse Gas Initiative – that has been in operation for several years, to illustrate how such carbon-control compliance costs and benefits have evolved over the initial years of that program. The paper also reviews the normal ratemaking practices and other regulatory policies in states across the country that are designed to mitigate rate impacts of investments and program costs affecting production and delivery of power to consumers. The goal of the Report is to reflect on recent experience to outline the tools states have to control costs and increase consumer benefits as they develop their plans.

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About Analysis Group

Analysis Group provides economic, financial, and business strategy consulting to leading law firms, corporations, and government agencies. The firm has more than 600 professionals, with offices in Boston, Chicago, Dallas, Denver, Los Angeles, Menlo Park, New York, San Francisco, Washington, D.C., Montreal, and Beijing.

Analysis Group's energy and environment practice area is distinguished by expertise in economics, finance, market modeling and analysis, regulatory issues, and public policy, as well as significant experience in environmental economics and energy infrastructure development. The practice has worked for a wide variety of clients including: energy producers, suppliers and consumers; utilities; regulatory commissions and other public agencies; tribal governments; power system operators; foundations; financial institutions; and start-up companies, among others.

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1. EXECUTIVE SUMMARY

On June 2, 2014, the United States Environmental Protection Agency (EPA) released proposed rules to reduce emissions of carbon dioxide (CO_2) from existing fossil power plants. EPA's "Clean Power Plan" would require significant reductions in CO_2 emissions from the power sector, while also providing each state the flexibility to determine its preferred way to comply with the new requirements.

EPA's analysis indicates that although there will be costs to comply with the Clean Power Plan, such costs will be much lower than the benefits to public health and to the overall economy from lower CO_2 and other air emissions.[1]

Some observers[2] have contended that consumers will experience net costs because, in those observers' view, overall compliance costs will outweigh economic and other benefits. EPA's analysis indicates that customers will see slightly higher electricity rates in the near term but lower electricity bills over the long run with the Clean Power Plan in place.

Based on our own analysis and experience, we believe that the impacts on electricity rates from well-designed CO_2-pollution control programs will be modest in the near term, and can be accompanied by long-term benefits in the form of lower electricity bills and positive economic value to state and regional economies.

There are sound reasons to be confident that customers can and will benefit from states' plans to lower the carbon intensity of their electric systems. First, and foremost, states have a long track record of using various regulatory and other policy tools to encourage utility programs and investments that minimize the cost of electric service, consistent with the myriad of public policies (tax, environmental, reliability, labor, and other areas of policy) that affect the provision of electricity. State officials (including utility regulators) are keenly focused on protecting electricity customers and will keep that objective front and center as they determine how to reduce CO_2 emissions.

Second, under the proposed Clean Power Plan, states will have the flexibility, experience and tools to prepare and implement State Plans that fit their circumstances, minimize costs of compliance, and provide benefits to customers. States can each put together the elements of plans well-suited to their state, and they'll have the ability to phase in changes over the 2020-2029 period in ways that accommodate smooth transitions. Although states differ in many ways – including their electric systems, their regulatory culture, and their electric industry structure – all states have programs,

[1] EPA has estimated that by 2020, compliance costs for the Clean Power Plan will fall in a range of $4.3 billion to $7.5 billion (2011$). For context, total expenditures on electricity in 2012 were $363.7 billion (2012$). (Source: Energy Information Administration (EIA) 861 database on electric revenues.) EPA's cost analysis tracks "the net change in the annualized cost of capital investment in new generating sources and heat rate improvements at coal steam facilities, the change in the ongoing costs of operating pollution controls, shifts between or amongst various fuels, demand-side energy efficiency measures, and other actions associated with compliance." EPA's analysis of benefits examines the effect of lower demand leading to lower costs to consumers, along with the expected economic, health, safety and environmental benefits of the rule. See EPA, Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants (hereafter referred to as EPA RIA), June 2014, page ES-8, Table ES-10, and the Executive Summary more generally.

[2] See, e.g., Institute for 21st Century Energy (U.S. Chamber of Commerce), "Assessing the Impact of Potential New Carbon Regulations in the United States," May 2014.

policies and practices that will allow them to develop plans that align well with their different circumstances while still complying with the new CO_2 emission requirements. For example:

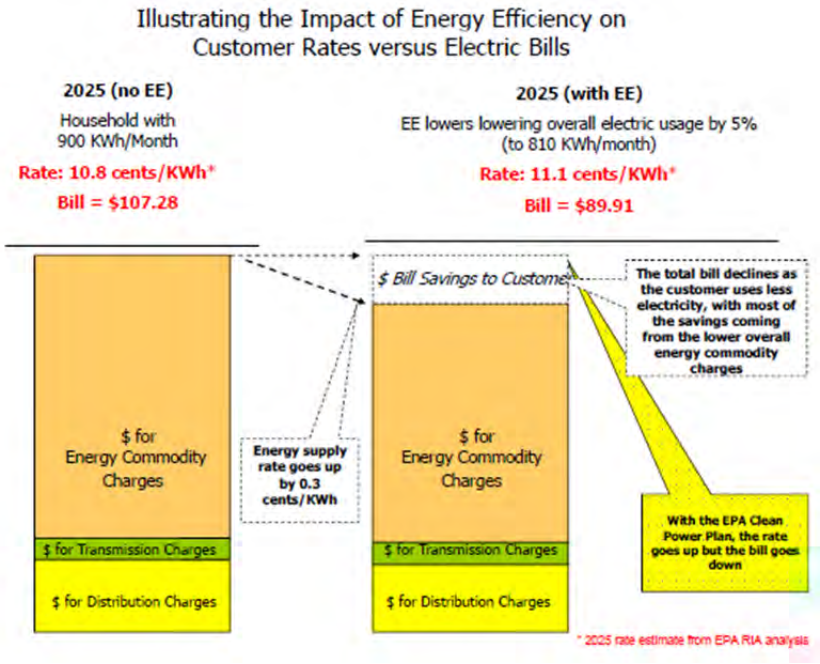
- States with vertically integrated utilities have mechanisms – including but not limited to integrated resource planning processes – for identifying least-cost compliance strategies. States have considerable experience and strong practical background in evaluating portfolios of supply and demand resources with costs and reliability in focus, and in encouraging long-term investments that minimize costs and maximize electricity consumer benefits.
- States with restructured electric industries can choose from a variety of market-based mechanisms that dovetail well with competitive retail and wholesale electric industry structures.
- Not surprisingly, in both areas, there will be continued opportunities in the future to use cost-effective energy-efficiency programs as part of states' CO_2 compliance strategies to help deliver significant benefits to customers and to local economies. Many states and utilities have deep experience in using energy efficiency as part of a least-cost utility resource plan or in competitive market contexts. Practices for design, implementation, administration, and evaluation of energy efficiency programs are readily transferable to states and utilities with less background in such programs. As the value of customer-side programs rises in the context of CO_2 compliance, states should expect to see more opportunities for cost-effective energy efficiency – and can use ratemaking tools to create incentives for utilities and others to pursue them.
- Additionally, many states are already introducing changes into their local utility systems to accommodate opportunities for customers to take actions – such as adopting energy efficient technologies in their buildings and operations – that will give customers the opportunity to be part of the solution in lowering carbon pollution from electricity production and use.

Third, market-based mechanisms offer unique opportunities to minimize costs while also reducing CO_2 emissions from existing power plants.

- States can implement such market-based programs within state boundaries. Moreover, states can work together – and with the stakeholders within each state – to develop and implement workable multi-state programs to control CO_2 emissions from existing power plants, in ways that fully preserve the rights of states in program design and administration. The EPA has not required states to develop their plans together, but the Clean Power Plan anticipates that many states may find it worthwhile to do so, in light of the way that electric systems and electrical resources are commonly shared across state boundaries.
- Such multi-state, market-based mechanisms to control CO_2 emissions can respect the practicalities of reliable electric system operations, and can be seamlessly integrated into both traditionally regulated and competitive electric industry settings.
- Pricing carbon – and this is likely true whether through a market-based mechanism or alternative compliance mechanisms – will help send efficient signals for new investment in resources (like zero-carbon technologies such as renewables and nuclear power plants, and in deeper energy efficiency measures) and for shifting power system operations toward power plants with lower carbon emissions.
- Market-based mechanisms – like the Regional Greenhouse Gas Initiative (RGGI) or California's cap-and-trade program – can provide opportunities for states to capture the economic value of

CO_2 emission allowances, and direct those revenues for consumer and public benefit. For example, in states with restructured electricity markets, states may choose to rely on methods to move CO_2 emission allowances into the market that avoid windfalls to owners of power plants. For the RGGI states, this has been accomplished through auctioning of CO_2 allowances. In other states (whether they have a traditional utility structure or a restructured market), another competitively neutral way to provide public/consumer benefits would be to allocate allowances for free to electric distribution utilities, who then can sell them to power generators and capture the revenues for consumers.

- Based specifically on our detailed analysis of states' experience with RGGI and the design of a wide array of programs that insulate lower-income consumers, we believe that the impacts on electricity *rates and bills* from well-designed CO_2-pollution control programs will be modest in the near term, especially for low-income customers. (See figure as example of the difference between rates and bills.[3])



Fourth, states are well equipped through long-standing utility ratemaking principles, practices and programs to help protect low-income customers when electricity costs increase. Such tools include discounted rates and arrearage management plans, dedicated funding for low-income energy-efficiency and weatherization programs, utility-driven charitable contribution programs, one-time emergency assistance programs, LIHEAP funding for heating and utility bill assistance, and disconnect/shut-off protection policies. Among the many states we found to be offering targeted energy efficiency programs for low-income customers are Colorado, Florida, Georgia, Illinois, Maine, Maryland, Michigan, Missouri, Montana, North Carolina, Ohio, and Texas.

In the end, the states are in control. State environmental, energy and utility-regulatory agencies will tailor compliance approaches to their individual circumstances, and in doing so will play a significant role in driving down and managing the costs of Clean Power Plan compliance through their plans.

[3] The difference between electricity *rates* and electricity *bills* is an important one in the context of many potential compliance approaches. In our prior analysis of the RGGI program, we found that while RGGI program costs initially had an increasing effect on electricity *rates*, the impact of energy efficiency investments (using RGGI allowance revenues) significantly reduced commercial and residential electricity use, placing downward pressure on *rates* over time, and combined with lower consumption, tended to generate on average much lower electricity *bills*. See: Paul Hibbard, Susan Tierney, Andrea Okie, Pavel Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States," November 15, 2011 (hereafter referred to as the AG RGGI Report).

Those State Implementation Plans (or simply State Plans) will define the set of actions that will work together to reduce emissions from fossil power plants. The components of the State Plans will affect compliance costs and collateral benefits. And states' regulatory and ratemaking policies can influence how compliance actions undertaken by owners of power plants and other actors translate into increases or decreases in electricity rates and bills to different types of consumers. We note that EPA's Clean Power Plan is quite different from the more typical federal air regulations affecting emissions from fossil power plants. Normally, owners of such plants are responsible for determining how to comply with regulations through investments, changes in operations, or – in some cases – a decision to retire a plant. Here, the states themselves may end up taking the actions to reduce emissions (e.g., through energy efficiency programs or appliance-efficiency standards or continued pursuit of renewable resources, none of which are necessarily operated or paid for by owners of fossil power plants). If included in a State Plan, such elements would affect the operations and costs of some fossil power plants, but would do so indirectly rather than through an action specifically undertaken by an owner of a plant subject to the EPA's rules. And in turn, such policies adopted by a state could affect overall compliance costs passed through to electricity consumers – as well as the character of the benefits they receive through state actions under the Clean Power Plan.

Our report explains the practical mechanics of how compliance costs tend to be passed through to electricity consumers in competitive and traditional electricity systems. We also draw on recent experience among existing carbon-control programs already in operation in some states to illustrate how program design and state ratemaking policies can influence the distribution of cost and benefit outcomes to consumers. The bottom line, in our view, is that states have the means to help ensure that compliance costs are as low as possible – and to provide benefits to local economies.

How should we think about compliance costs in this context? To start with, controlling and reducing CO_2 will tend to increase the cost of doing business for many owners of affected plants, whether compliance is achieved through investments to increase a plant's efficiency, or through controls on a plant's operations that reduce its output (and associated revenues), and/or through the purchase of CO_2 allowances in a cap-and-trade program. Changes in plant operations (e.g., lower output, lower revenues from power sales) could also result from other components of a State Plan, for example, if a state were to include energy efficiency programs or renewable energy requirements or measures to retain existing nuclear plants as part of the power supply. These latter actions could lower the amount of power produced overall at fossil-fuel power plants, and help to offset potential costs associated with lowering the emissions from fossil-fuel power plants. States may choose to pursue these latter options because they could substantially help to lower the overall costs of compliance with the Clean Power Plan.

How could such compliance costs translate into impacts on consumers' electricity bills? This is a bit more complicated. In many parts of the U.S., there is not a straight line connecting the costs incurred by the owners of the power plants directly affected by EPA's Clean Power Plan, and the costs, benefits and state/regional economic impacts experienced by electricity consumers and other players in the electric industry. In fact, the relationship between power plant owners' compliance costs and consumers' prices will vary significantly, depending upon many factors (such as whether the local electric utility owns any power plants, or what things a state includes in its State Plan). For example:

- Approximately two-thirds of the nation's electricity customers live in regions where an independent grid operator runs a competitive power market. In these parts of the country –

including California, Texas, much of the Midcontinent region, the MidAtlantic area, and the Northeast – electricity customers pay prices based on the costs of the power plant operating on the margin in any hour, and thus do not necessarily reflect every dollar of compliance costs incurred by owners of all power plants. This results from the way that electricity prices arise in these markets (which we explain later in our report).

- Ten of the nation's states (California and the nine member states that participate in the Northeast/MidAtlantic region's RGGI program) already participate in a carbon cap-and-trade program, with compliance costs incurred by some – but not all – power producers already reflected in electricity prices.
- Across the country as a whole, approximately two-thirds of power is produced by electric utility companies (investor-owned utility companies, municipally owned utilities and electric cooperatives).[4] In these contexts, state utility regulators and boards of public-power companies and cooperatives typically allow pass-through of costs and investments associated with environmental compliance activities. However, collection of these costs from customers usually requires least-cost planning processes and/or other cost-minimization steps as a condition of recovery, in order to maintain the incentives for efficient, operations and investment, and to keep overall compliance costs low.

There clearly are a number of strategies that states can include in their State Plans to at least partially offset the impact of program costs on consumers. Experience demonstrates that some approaches can even generate net benefits to electricity customers and the larger state economy. An example of the latter is the RGGI states' auction of CO_2 allowances and use of the auction proceeds to support energy efficiency and customer bill credits; we have previously concluded in our detailed study of RGGI's first three years that it provided net benefits to customers and the economy of each participating state, and we update that prior analysis here to encompass over five years of experience with a CO_2 market-based trading program.[5]

There are other emission-credit trading approaches focused on consumer protection, cost mitigation or other objectives that could be adopted and implemented by states, such as the one proposed by the Clean Air Task Force (CATF). CATF's proposed mechanism would allow states "to mitigate retail electric rate impacts and protect all classes of electric ratepayers (industrial, commercial and residential) in all power markets by allowing for compensation to ratepayers…[and] to use a portion of the allowance allocations to compensate merchant coal generators for losses in asset value that may occur due to the program."[6] In both of these approaches – one an actual program (RGGI), the other an alternative design – states' voluntary agreements to use a multi-state approach helps to keep

[4] In more than half of the states, the local utility owns more than 70 percent of the power plant capacity. (Source: EIA 860 database for 2012.) Typically, state utility regulators in states with utilities that own power plants determine whether large capital investments at those plants are prudent, used and useful, and appropriate to be included in "just and reasonable" rates charged to customers. In many such states, the regulators review utilities' plans for capital investments at power plants are part of least-cost planning processes.

[5] AG RGGI Report.

[6] Conrad Schneider, "Power Switch: An Effective, Affordable Approach to Reducing Carbon Pollution from Existing Fossil-Fueled Power Plants," Clean Air Task Force, February, 2014, with accompanying technical analysis by Bruce Phillips, " Alternative Approaches for Regulating Greenhouse Gas Emissions from Existing Power Plants under the Clean Air Act: Practical Pathways to Meaningful Reductions," The NorthBridge Group, February 2014 (together, hereafter referred to as CATF Proposal).

compliance costs low and mitigate impacts on affected entities. EPA's own benefit/cost analysis also supports this conclusion.[7]

Finally, creative approaches by states to address potential compliance costs, mitigate impacts on all consumers, and achieve various policy objectives will all be layered on top of a deep level of commitment and practice states have in managing electric industry costs. States have many decades of experience with electricity rate design, program benefit and cost allocation, and compliance program planning and implementation that will help guide an equitable distribution of program costs and benefits, while protecting lower-income customers.

We hope that our report provides states with ideas for how they might apply their experience and expertise in preparing State Plans to lower overall compliance costs and provide economic benefits to consumers and to the local economy. We assume that as states begin to consider what to include in their plans (as many states have already begun), they will do so by convening stakeholder processes to identify and weigh options and by assuring that personnel from different relevant state agencies are involved in those discussions. (The experience of Illinois and several other Midwest states are a few great examples.)

Although EPA's Clean Power Plan anticipates that a state's air regulatory agency will be the entity to present a state's plan to the EPA, our experience in state government[8] informs us of the value of ensuring that all relevant state agencies (utility regulators, state energy offices, climate policy advisors, consumer protection branches, in addition to state environmental regulators) participate fully in the development of State Plans. Given the differences that exist among states in terms of the scope and depth of agency authorities, skills, and expertise, and given the fact that EPA's Clean Power Plan will lead to policies that directly and indirectly affect operations of the electric system and consumer prices, bringing more and different points of view to the task will likely improve the quality, costs and benefits of State Plans. State utility regulators, for example, will have a critical role in assuring that implementation of the EPA requirements occurs in a least-cost fashion and in assuring a fair allocation of costs and benefits of such actions. State energy offices often also have responsibility for many aspects of electricity use in appliances and buildings, and in managing renewable programs.

[7] "The proposed emission guidelines provide states with options for establishing standards of performance in a manner that accommodates a diverse range of state approaches. The proposed guidelines would also allow states to collaborate and to demonstrate emission performance on a multi-state basis, in recognition of the fact that electricity is transmitted across state lines, and local measures often impact regional EGU CO2 emissions." EPA RIA, page ES-2, Table ES-4, and the Executive Summary more generally.

[8] Paul Hibbard was recently Chairman of the Massachusetts Department of Public Utilities (DPU), and previously had worked in the state's air regulatory division. Sue Tierney previously served as Secretary of Environmental Affairs, Commissioner of the DPU, and senior economist at the energy office in Massachusetts, and was subsequently Assistant Secretary for Policy at the U.S. Department of Energy.

Our report describes our assessment of states' actual experience with RGGI, and of the larger body of ratemaking practices in states around the country through which regulators ensure fair and equitable rates to customers. In the latter, we examined a wide and diverse cross-section of states (covering half of the states in the U.S., as shown in the figure at the right), in order to point to the many tools available to states to manage the distribution of compliance costs and economic benefits among customers.

Clearly, State Plans approved by the EPA will create the framework for the industry's compliance with EPA's Clean Power Plan. How compliance plans are designed by the states will strongly affect the *magnitude* and *distribution* of costs and benefits among consumers, power plant owners, and the general economy. The regulatory practices for passing on costs to electricity consumers is also important, as it can influence the degree and allocation of program costs and benefits.

In the following sections, we discuss the analyses that allowed us to reach the conclusions noted above. Section 2 briefly summarizes EPA's proposed Clean Power Plan, and the role it anticipates for states in developing State Plans to control CO_2 emissions from existing power plants. We describe the wide range of compliance options available to states. In Section 3, we explain how different State Plan options may affect compliance costs, and how those costs may impact consumers' electricity rates and bills. Those impacts will vary across the country, due to several factors including: the different emission-reduction targets assigned to each state; the structure of the electric industry in the state (e.g., traditional utility-owned generation versus independent power production; vertically integrated utility operations versus wholesale competitive markets). We further highlight the importance of state program design on the economic benefits and costs of program implementation.

Section 4 reviews the experience of RGGI in the Northeast states, with RGGI being the long-running market-based CO_2 control program in the U.S. This discussion illustrates how a multi-state approach can operate seamlessly as part of the electric system, lead to efficient price signals affecting power plant dispatch, reduce emissions, and provide opportunities to control compliance costs and enhance benefits to consumers. Our review of RGGI's experience focuses on a recent economic analysis of the program, supplemented with a review of up-to-date data on continuing RGGI auctions and spending of allowance revenues.

Finally, in Section 5, we review state ratemaking practices and public policies that allow for fair cost recovery across all consumers, and for protecting low-income customers in particular. Appendix 1 provides more detail on EPA's proposed Clean Power Plan. Appendix 2 summarizes how RGGI states have used the proceeds from selling CO_2 allowances (e.g., to invest in energy efficiency programs, to provide a credit on customers' electricity bills and for other purposes including payments to the state's general fund). Appendix 3 compares state electricity revenues and spending on energy efficiency program by customer class, to illustrate how states can design those programs to support efficiency improvements for different types of customers. Appendix 4 provides case studies of electricity consumer-protection policies, to illustrate the tools currently in place in half of the states in the U.S.

2. EPA'S PROPOSED CLEAN POWER PLAN

On June 2, 2014, the U.S. EPA proposed rules to reduce CO_2 emissions from existing electric generating units (EGUs) through Section 111(d) of the Clean Air Act (CAA). The proposed rules, called the "Clean Power Plan," are anticipated to lower CO_2 emissions from the power sector by 30 percent relative to levels in 2005. Under the CAA, EPA establishes the target level of emission reductions for each state, and the states develop (and submit to EPA for approval) State Plans to meet EPA's requirements.

EPA's proposal sets state-specific standards, in terms of pounds of CO_2 allowed to be emitted per megawatt-hour (MWh) of electricity produced at affected facilities. In setting the standards applicable to each state's power plants, EPA used a standardized methodology based on assumptions about the amount of emissions reduction that could occur through investments and operational changes at affected power plants, through zero-carbon generating sources, and through energy efficiency. (EPA refers to these as the "building blocks."[9]) No state, however, is required to use all of those approaches.

EPA's Proposed Clean Power Plan:

- State-specific targets to reduce CO_2/MWh produced at existing fossil-fuel power plants.
- Two compliance periods: 2020-2029 (averaging compliance over the decades, to meet an interim target) and another by 2030.
- State Plans to be submitted to EPA to show how the state and the power plants within it will comply with the targets.
- States have the flexibility to propose a wide variety of options in their plans, including actions that directly affect emissions from fossil power plants (EGUs) and actions that indirectly affect those EGUs' emissions (such as through energy efficiency, policies that encourage more investment in zero-carbon power generation technologies, or changes to electric transmission infrastructure).
- States may propose market-based mechanisms.
- States may join together for regional plans.
- States may use a "rate-based" approach (i.e., CO_2/MWh) or a "mass-based" approach (i.e., a total amount of CO_2 allowed to be emitted in the state, sometimes also called a CO_2 budget or cap).

States may choose from a wide variety of potential compliance mechanisms, actions and investments. Among the many options are: modifications at existing EGUs to increase their power-production efficiency; operating limits at EGUs; real or shadow prices on carbon emissions; carbon taxes; emission-averaging across power plants; participation in single state or multi-state market-based emission-trading programs; reliance on non-fossil alternatives, including ones that reduce demand through energy efficiency (and therefore reduce output at fossil plants), and others that retain/increase low/zero-CO_2 emitting resources (e.g., new renewable energy and existing or new nuclear capacity).

Each state's choice of what elements to include in its State Plan will affect compliance benefits and costs in that state. On the one hand, a State Plan could require investments to improve the efficiency of each power plant affected by the Clean Power Plan, along with other measures to cause some of the most-polluting plants to operate on a restricted basis. Based on what is known at present,

[9] The four building blocks EPA used to set state-specific emission-reduction targets reflect the potential to reduce emissions through:

- Improving operating efficiency or otherwise reducing CO_2/MWh at EGUs.
- Shifting output at power plants with high CO_2 emissions (e.g., at coal-fired units or inefficient gas/oil plants) through increased output at plants with lower CO_2 emissions per MWh generated (i.e., at natural-gas combined cycle (NGCC) units).
- Substituting output at fossil EGUs with retention or addition of output at zero-carbon generation (renewables and nuclear); and
- Reducing emissions from affected EGUs by lowering overall demand for electricity through additional energy efficiency.

however, this would not necessarily minimize overall compliance costs.[10] On the other hand, using approaches that send appropriate CO_2-related price signals could help to minimize costs.

States may be able to layer on various approaches as part of their State Plans. For example, rather than requiring a certain average level of emissions at each plant, a state with vertically integrated utilities could decide to allow all of the plants owned by a particular company to average the emissions across its fleet. This might lead to retirements of some older and less efficient power plants, in exchange for allowing continued operation of coal-fired power plants that have recent investments in equipment to control mercury and other toxic emissions. States can determine how to adopt cost-sharing approaches so that those customers that benefit from such flexibility may share some of those benefits with customers of other electric companies needing to do more.

A state also could select market-based approaches that allow pursuit of the cheapest compliance options first (and thus produce a lower overall compliance cost) within that single state. And states may decide to enter into agreements with other states that establish an overall blended-average emissions cap, and allow owners of plants in multiple states to trade their emissions reductions so that on average, all plants in the relevant states achieve the average emission-reduction target.

Because states may choose from such a wide variety of potential compliance options, EPA's cost/benefit analysis estimated outcomes under a number of assumptions about how states would craft their plans. Based on these analyses, EPA concluded that potential costs will be more than offset by reduced demand (which would lower overall production costs to consumers) and by the expected economic, health, safety and environmental benefits of the rule.

Although projections of pollution program costs always rely on inherently uncertain information before a program actually goes into effect, prospective estimates of the costs of pollution-control regulations have historically exceeded actual program costs.[11] This tends to occur for several reasons, most notably the fact that it is difficult to anticipate in advance how technology innovation will occur, even if it is well understood that such innovation will likely occur in response to regulation.[12]

In this particular case, the EPA does not know now what specific actions individual states – or groups of states – will incorporate into their State Plans. The actual economic costs of the Clean Power Plan will depend strongly on the decisions that states make in developing and implementing their State Plans, industry's responses to these decisions, and the nature and pace of technological change driven by compliance activities. Additionally, state practices regarding review of utilities' compliance plans and recovery of costs related to them will affect the magnitude and distribution of consumers' costs. In all states – whether they have a vertically integrated or restructured electric industry – ratemaking practices can affect the impacts on different customer segments (including low-income customers).

[10] See, for example: Joshua Linn, Erin Mastrangelo, and Dallas Burtraw, "Regulating Greenhouse Gases from Coal Power Plants under the Clean Air Act," Resources for the Future (RFF), February 2013; Dallas Burtraw, Joshua Linn, Karen L. Palmer, Anthony Paul, "The Costs and Consequences of Clean Air Act Regulation of CO2 from Power Plants," RFF, January 2014.

[11] Winston Harrington, Richard Morgenstern, and Peter Nelson, "On the Accuracy of Regulatory Cost Estimates," RFF, 1999; Hart Hodges, "Falling Prices: Complying with Environmental Regulations Almost Always Less Than Advertised," Briefing Paper, Economic Policy Institute, 1997; Ruth Ruttenberg, "Not Too Costly After All," prepared for Public Citizen Foundation, February 2004.

[12] National Academy of Sciences, "America's Energy Futures Report, 2008, pages 97-102; International Energy Agency, "Experience Curves for Energy Technology Policy" (2000).

3. CONNECTING THE DOTS: EPA'S PROPOSAL AND POTENTIAL ECONOMIC IMPACTS ON ELECTRICITY CONSUMERS

EPA's proposed Clean Power Plan will have various positive and negative effects on consumers and the economy. In its benefit/cost analysis, EPA identified a number of potential economic impacts (positive and negative), including: (1) direct compliance costs incurred by owners of affected power plants (and passed along, in part, to electricity consumers); (2) expenditures on power production facilities with low or no carbon emissions; (3) expenditures on energy efficiency measures; (4) changes in the markets for fuels (e.g., coal, natural gas) used to produce electricity; (5) the expected direct and indirect social, economic, health and environmental benefits from mitigation of climate change; and (6) public health benefits from reduction in combustion of fossil fuels.[13]

Although the fundamental purpose of EPA's proposed control of CO_2 emissions is to obtain the benefits that come with avoiding climate change impacts (that is, capturing the impacts quantified in item (5) above), much attention will undoubtedly be focused on the proposal's implications for direct and indirect costs relating to items (1) through (4) above. (Unfortunately, many parties will overlook that expected impacts that produce public health benefits (6).) The close attention paid to direct and indirect economic impacts is inevitable given the importance the public places on near-term energy costs and economic productivity. Consequently, we summarize how compliance costs translate to economic impacts on electricity consumers.

There are a myriad of ways in which implementation of EPA's Clean Power Plan will shift the flow of dollars associated with the production and consumption of electricity over time, generating additional direct and indirect economic costs and economic benefits. The impacts will ripple through the electric sector in many ways, for example by:

- changing the costs to generate electricity at different power plants;
- changing the demand for different fossil fuels;
- prompting the retirement of some generating assets, the retention of some generating assets that would otherwise retire, and the addition of different electricity generation and storage resources than would otherwise occur;

[13] EPA, RIA, Executive Summary. "The annual incremental cost is the projected additional cost of complying with the proposed rule in the year analyzed and includes the net change in the annualized cost of capital investment in new generating sources and heat rate improvements at coal steam facilities, the change in the ongoing costs of operating pollution controls, shifts between or amongst various fuels, demand-side energy efficiency measures, and other actions associated with compliance….[The costs] represent the estimated incremental electric utility generating cost changes from the base case, plus end-use energy efficiency program costs (paid by electric utilities) and end-use energy efficiency participant costs (paid by electric utility consumers)." EIA, RIA, Page ES-8. "Implementing the proposed guidelines is expected to reduce emissions of CO2 and have ancillary emission reductions (i.e., co-benefits) of SO2, NO2, and directly emitted PM2.5, which would lead to lower ambient concentrations of PM2.5 and ozone. The climate benefits estimates have been calculated using the estimated values of marginal climate impacts presented in the *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866*,...Also, the range of combined benefits reflects different concentration-response functions for the air pollution health co-benefits, but it does not capture the full range of uncertainty inherent in the health co-benefits estimates. Furthermore, we were unable to quantify or monetize all of the climate benefits and health and environmental co-benefits associated with the proposed emission guidelines, including reducing exposure to SO2, NOx, and hazardous air pollutants (e.g., mercury and hydrogen chloride), as well as ecosystem effects and visibility impairment. These unquantified benefits could be substantial, but it is difficult to approximate the potential magnitude of these unquantified benefits and previous quantification attempts have been incomplete." EIA, RIA, pages ES-9 and ES-10.

- changing the price of power passed along to electricity customers;
- altering the amount of electricity consumed by customers as a result of energy efficiency compliance investments;
- spurring or accelerating growth in emerging technologies and industries that address carbon emissions at power plants or that meet electricity demand through less carbon-intensive ways;
- accelerating consumer- and business-based investments in on-site conservation, load reduction, and behind-the-meter renewable generation technologies; and
- other impacts not understood or imagined today.

These impacts will introduce costs and benefits for different parts of the local and regional economies in ways that are challenging to predict with precision at the outset of the program. It is possible, though, to explore how such costs and benefits arise in different parts of the economy.

In the first instance, controlling and reducing CO_2 will tend to increase costs for owners of power plants affected by the rule. This is the part of the cost equation that usually gets the most attention in public discussions of environmental regulations: Compliance will increase the cost of doing business for affected plant owners in ways determined by a state's plan – e.g., through on-site investments to increase power plant efficiency or otherwise reduce plant emissions of CO_2, through company-wide costs incurred in an emissions averaging program, through the purchase of CO_2 allowances in a cap-and-trade program, or through payments associated with a carbon charge, fee or tax mechanism.

All else equal, power producers will attempt to pass along such costs in the prices they charge for generating electricity. In states where electric utilities own affected power plants, such costs will tend to be passed along to those utility's consumers through regulated rates as a pass-through of a variable expense, or as recovery of and a return on compliance capital investments. (That result will undoubtedly occur in the parts of the country where municipally owned utilities and electric cooperatives end up taking actions at the power plants that they own.[14]) In states where non-utility generators' costs are not part of a utility's rate base or expenses, but are recovered through competitive wholesale energy markets, generators will include such costs in their market offers but these compliance costs will only flow through to consumer prices if and to the extent an affected unit is actually setting the price of electricity.[15]

Changes in the cost of operating different types of power plants will affect their dispatch. In principle under the normal "economic dispatch" arrangement similar to those in power systems everywhere

[14] This result is tied to the fact that municipal utilities do not have shareholders and must cover their costs through rates charged to consumers. For electric cooperatives, the members are both customers and shareholders, so the same result is true.

[15] In competitive markets, there is not a one-to-one correspondence between costs incurred by owners of power plants and wholesale prices that are passed along to retail electricity customers. For example: in circumstances when the CO_2 compliance cost per MWh for an inefficient coal unit is higher than for an efficient, natural gas combined cycle unit, the degree to which the CO_2 control program increases the price of electricity in a given hour is a direct function of the extent to which a unit is setting the price of electricity (the "marginal" unit). In an hour when a non-emitting unit is marginal and setting the price of electricity, the impact on electricity price of the program in that hour is zero. But conversely, in hours when the least-efficient coal unit is setting the price of electricity, the CO_2 program would affect the marginal electricity price. Over the course of the year, the extent to which the CO_2 compliance expense (on producers) leads to increases in electricity prices in organized wholesale competitive markets is a function of the extent to which (and how often) CO_2-emitting resources are on the margin and setting the price of electricity. The impact on electricity costs over the course of the year is in turn a function of this impact on electricity prices and the extent to which – through consumer choice or program investments (in energy efficiency or renewable energy) – the CO_2 program leads to a reduction in electricity consumption.

around the country, the grid operator (e.g., the utility for a vertically integrated power system, or the independent system operator in an 'organized' wholesale market) schedules plants to operate so as to minimize the overall cost of production on the system. If it becomes more expensive to generate power at a particular coal plant due to a State Plan's elements, then the grid operator will turn to a cheaper source of power (e.g., a gas-fired combined cycle). (This could happen in a number of ways, consistent with economic-dispatch principles: for example, the cost to operate the coal plant could rise because it faces a new price on carbon (e.g., through a state tax on carbon, or through the need to purchase CO_2 emission allowances, or through use of a 'shadow' price on carbon applied in the dispatch equation) or because it has a new constraint on its ability to operate (e.g., through a change in that plant's operating permit to limit its output over the course of a year.)[16] The extent to which this occurs will depend on a region's resource mix and its demand over all hours of the year. Under the standards proposed by EPA, it is likely that some of the more efficient coal-fired power plants will be able to continue to produce power relatively inexpensively for some time, and they will continue to be dispatched.

Nevertheless, as these changes occur in the relative costs to produce power from different plants, there will be shifts in the electric system. (These have been anticipated by EPA in its application of the "building block" methodology used to set state-specific CO_2 targets.) Some plants may retire; others will operate less; others will operate more. Other zero-carbon-emitting plants that tend to be dispatched whenever their fuel supply is available (e.g., nuclear power plants; wind turbines; solar panels) may not see significant changes in output.

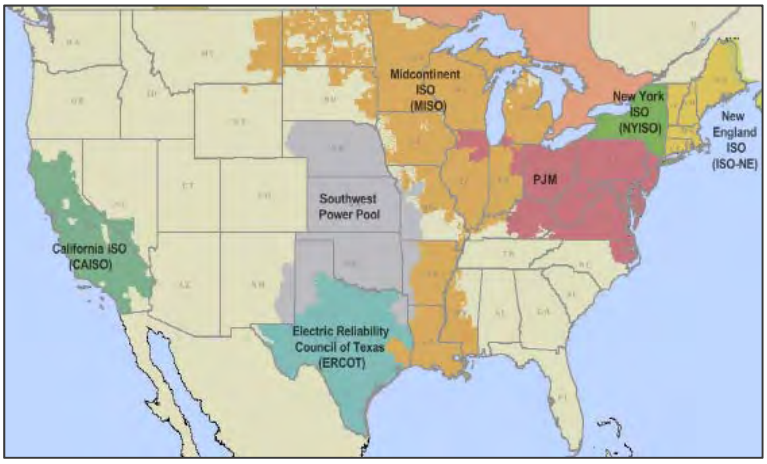
There is not a direct line, however, connecting the changes in costs incurred by owners of power plants and the actual costs, benefits and state/regional economic impacts experienced by consumers or other economic actors (e.g., fuel suppliers, owners of non-fossil power plants).

For example, among electric industry participants, some plant owners will face higher costs and/or lose revenues, while others will gain revenues and market opportunities. Older CO_2-emitting assets that have operated profitably for many decades may no longer be able to do so. But newer, more efficient and lower-emitting fossil-fired units will tend to operate more. In some parts of the country (e.g., the Rockies, or in the Southeast), some of those changes will occur within a single utility's own power plant portfolio. In addition, depending upon how states design their State Plans, those changes could also arise across the power plants owned in different states by that single utility (such as might occur in the Southeast states).

In states where the power plants operate as part of single state or regional 'organized' power market (shown in the colored areas of the map below), those shifts in output could occur among facilities owned by different power plant owners. How they shift will be influenced by the design of those states' State Plans, and the resulting approaches to compliance selected by owners of affected EGUs.

[16] We are aware of real-world examples of several of these approaches: For example, in the RGGI states, power generators' offer prices into the energy markets administered by regional transmission organizations (i.e., in the ISO New England market, in the New York ISO market, and in Maryland and Delaware, which are part of the PJM wholesale market), reflect a price on carbon through the generators' inclusion of the opportunity cost of carbon as part of its energy offer price. In Massachusetts, some gas-fired power plants with dual-fuel capability have limits in their air permits that allow them to be dispatched (on oil) no more than the equivalent of 30 days at full output. In each case, the grid operator incorporates these factors into its economic dispatch that includes these generating units.

Given the market-based structure of the wholesale electric systems in these regions, there are strong rationales for State Plans to include market-based mechanisms for controlling carbon emissions. Such approaches could be a single-state or multi-state cap-and-trade program (e.g., like California's or in the Northeast/MidAtlantic states) or a carbon tax (being considered in some regions in the Pacific Northwest), or a dispatch shadow-price approach (also under discussion in some states in the Midwest).



In wholesale markets where state plans lead to some form of a price on carbon, owners of plants with lower CO_2/MWh emission rates will likely increase their output to the extent they can. The changing market price relationships will affect the economic opportunities and profits for existing or emerging electricity market participants – some positively, and some negatively. (See the text box below.)

In addition to the fact that not all compliance costs are passed on to consumers, the way a program is designed and implemented can actually deliver additional program cost reductions. For example, to the extent that State Plans directly or indirectly increase utilities and/or consumers' investments in

Compliance Cost Impacts on Owners of Assets in "Organized" Competitive Wholesale Markets:

Assume an hour when an efficient, natural gas combined cycle power plant is the last one dispatched to meet load, and thus sets the price paid to all generating units operating in that hour. Assume too that the plant operates in a state with a State Plan that includes some form of price on its carbon emissions (as now occurs in the 9-state RGGI region) The price offered by the natural gas plant contains a variable cost, in dollars per MWh of generation, based on its opportunity cost related to its emissions of CO_2 in that hour (e.g., by purchasing allowances, paying a tax or fee). This will affect various power plant owners in the following ways:

- *The clearing natural gas-fired unit*: The unit that sets the clearing price will exactly recover its compliance cost, and the price increase for energy in the wholesale market will increase (relative to a no-carbon control program) by the cost of compliance for a natural-gas combined-cycle unit. All gas-fired units with similar heat rates will face similar circumstances. In effect, there may be little impact on profits for such asset owners.
- *Low/zero-emitting units*: Many renewable resources (such and wind and solar) have very low operating costs, and typically would be operating (or inframarginal) in the same hours as the gas plant above, and would receive energy market revenues roughly equal to the market price times MWh output. Since the price of energy is higher with the CO_2 price in effect, the profits for these low-emitting units are higher. Nuclear and hydro units would experience a similar effect on profits in this hour.
- *Inefficient coal-fired unit*: An inefficient coal unit faces a higher compliance cost than the gas unit in $/MWh since it emits more tons of CO_2 per MWh. Yet the impact of the program increases electricity prices only by the $/MWh compliance cost of the unit of the margin (e.g., the gas plant). Thus, the coal unit's costs increase more than its revenues, so the effect of the program is to decrease profits for this unit. A directionally similar impact would be felt by less efficient natural gas and oil units, to the extent they are operating.
- *Zero-emitting marginal unit*: In hours when the price of energy is set on the margin by a zero-emitting unit (e.g., renewables, nuclear, hydro) – not the typical occurrence – any operating fossil-fueled unit is receiving less profits (than the case without a carbon control requirement), and there is no price increase paid by consumers with respect to the carbon control program.

energy efficiency or technology-driven load control or behind-the-meter renewable technologies, the associated reduction in demand for power generation has the effect of lowering CO_2 compliance costs, or even producing net benefits for electricity customers. This is because reducing consumptions lowers a business or homeowner's electricity bill, and lowering *total system* demand in any hour will tend to reduce the clearing price for power for *all users* of electricity, whether they themselves invested in an energy efficiency measure or not. This creates opportunities for State Plans to incorporate elements that offset the cost impacts from other compliance actions.

The net effect of such considerations can strongly influence the impact of EPA's program on electricity costs over time.[17] Depending upon the design of State Plans to include energy efficiency, any initial price increases experienced by electricity consumers may be more than offset over time by lower electricity bills. (EPA's benefit/cost analysis indicates that "average monthly electricity bills are anticipated to increase by roughly 3 percent in 2020, but decline by roughly 9 percent by 2030 because increased energy efficiency will lead to reduced usage."[18] The CATF has proposed an approach to CO_2 compliance that would limit price impacts to no more than 2 percent.[19] And in its recent analysis of the potential compliance strategies for ERCOT, the Brattle Group found that Texas could meet both resource adequacy and carbon-emissions reduction goals through a combination of increased reliance on gas-fired generation, demand-response, combined heat and power, and energy efficiency at inflation-adjusted prices that resembled those experienced in the 2010-2012 period.[20])

From the point of view of state or regional economies, the direct impact of compliance on producer profits and electricity consumer costs is still just one piece of the larger economic puzzle. All of the direct changes in costs, investments, and producer and consumer actions discussed above ripple through the economy in various ways. As the profits of the owners of affected units fall, for example, their spending in the economy drops (e.g., by perhaps deferring spending on operations and maintenance, or by reducing the disposal income of company shareholders), negatively affecting economic activity. The opposite impacts occur when other plants increase their output (e.g., greater demand for and production of natural gas in different regions of the country, with jobs and tax

[17] For example, in the RGGI Report we found that: fossil generators' inclusion of CO_2 allowance prices in their offer price tended to change the order of dispatch of various power plants, and tended to increase electricity prices (by less than 1 percent) in the near term; encouragement of energy efficiency; also, the use of the proceeds from auctioning off CO_2 allowances to fun energy efficiency investments also altered the load profile, lowered overall demand, and in turn lowered electricity prices (because of avoiding the need to dispatch higher-priced supply on the margin). In these regions, the generation sector as a whole earned less revenues than they would have absent the RGGI program being in place. However, owners of low- and zero-carbon emitting plant gained substantial revenues, while fossil-fired units lost revenues. Since many of the zero-emitting facilities were new renewable generation assets within the affected states, the net effect of the program was to retain a greater share of generation sector revenues within the region, producing local economic benefits (on top of those provided by the local investments in energy efficiency measures).

[18] EPA RIA, page ES-24.

[19] The CATF Proposal would accomplish this through a combination of several things: providing states with the opportunity to use "mass-based, fossil boiler emission budgets" as an alternative to complying with an emission rate standard; allowing interstate emissions trading; offering states the ability to mitigate retail ratepayer and merchant coal impacts through free allowance allocations ("Giving states an emissions tonnage budget provides states with "free" allowance allocations, the value of which can be used to mitigate ratepayer impacts and compensate merchant coal generators for lost asset value." CATF Proposal, pages 4, 14.

[20] "In inflation-adjusted terms, prices in the Reference scenarios remain within the band observed between 2010 and 2012, from a low of about $42/MWh to a high of about $67/MWh under the strong carbon rule. Importantly, the inclusion of EE, DR, and CHP [energy efficiency, demand response and combined heat and power] in the Phase III scenario reduces the higher-priced carbon rule scenarios, as what would otherwise have been." See: Ira Shavel, Peter Fox-Penner, Jurgen Weiss, Ryan Hledik, Pablo Ruiz, Yingxia Yang, Rebecca Carroll, and Jake Zahniser-Word (The Brattle Group, "Exploring Natural Gas and Renewables in ERCOT, Part III: The Role of Demand Response, Energy Efficiency, and Combined Heat & Power," May 29, 2014, pages 6 and 77.

revenues associated with them; potentially greater need for new investment in pipelines, with construction jobs and equipment purchases associated with such infrastructure investment).

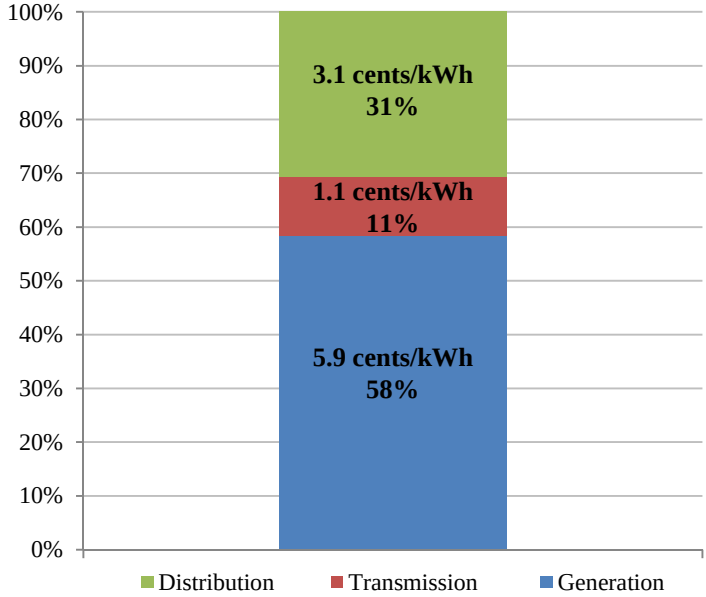
Also, where revenues rise for owners of power facilities with zero carbon emissions that previously were undervalued or not sufficiently compensated in electricity markets, an owner may be able to keep the plant open (e.g., a nuclear unit that may have been previously financially challenged) or add new capacity in the future (e.g., a new wind turbine or solar PV system, or an uprate at an existing hydro facility or nuclear plant). Those will have investment and job impacts in their regions.

Where energy efficiency is part of a State Plan, it will tend to increase economic activity in the local economy, through sales of efficient electric devices or insulation, and/or through jobs associated with audits, installations, and other parts of the energy-efficiency supply chain. In some communities, there will be gains in manufacturing of energy-efficient equipment.

On the consumer side, to the extent that program implementation increases electricity costs, consumers will tend to have less disposable income. There are tools that states can use to partially or entirely mitigate the impact of program costs on consumers, and in some cases actually generate consumer and broader net economic benefits. As we explain further below, State Plan designs that flow revenues back to electricity customers (e.g., through a credit on customers' electricity bills) can mitigate the impact of power supply price increases. Those that lead to increased investment in energy efficiency and lower consumption of electricity are particularly effective in lowering total customer payments for electricity and increasing disposable income (even if there are initial rate increases). Such income effects can increase economic benefits in local economies.

Although most discussions of the EPA's proposed Clean Power Plan will inevitably focus on costs of compliance, states should consider possible ways to design their State Plans to minimize those costs and increase the economic benefits of reducing CO_2 emissions from the power sector. Discussions and analyses that only address the former without paying attention to the latter will lead to incomplete assessments of the proposed Clean Power Plan's impact on consumers and the economy. A complete story on the impact of program implementation *on electricity consumers* must include a more review of the overall impact of the program on electricity market infrastructure and pricing dynamics, the investment of program revenues, the changing character of the electric industry (with much-greater investment by utilities, third parties and customers on the customer side of the meter) and the actions and response of electricity consumers. A complete story on the impact *on economic productivity and jobs* must follow how changes in investment and spending from the program – including producer costs/revenues, consumer income, and program investments – flow through the broader economic setting.

Finally, it is important to keep in mind that the impact of the Clean Power Plan on electricity prices – through increased costs at some power plants – is incomplete in the sense that it examines and over-emphasizes only one part of the electricity cost structure. A typical electricity bill includes other elements besides costs relating to electricity supply – namely, the costs to transmit and distribute electricity to the end user, and costs to manage power system operations and markets. Of the all-in price of electricity (on the basis of the national average cent/kWh), approximately 40 percent of the costs relate to the delivery (distribution and transmission) of electricity, and 60 percent relate to power production. Thus, for a 1-percent change in the price of electricity generation, there will be a smaller change (less than 1 percent) in the bottom-line price of electricity.



Notes & Sources:
[1] Average across all customer classes.
[2] Does not include any state- or utility-specific charges.
[3] U.S. Energy Information Administration, Annual Energy Outlook 2014, Reference Case, Table A8: Electrical Supply, Disposition, Prices and Emissions.

Also, where states include in their State Plans a variety of elements that encourage cost-effective energy efficiency, demand-response and renewable projects on customers' premises, these will tend to lower overall demand for power and in turn lower average cost of electricity supply.

4. PROGRAM DESIGN CONSIDERATIONS: REVIEW OF THE REGIONAL GREENHOUSE GAS INITIATIVE

Overview

How EPA's proposed Clean Power Plan ultimately impacts consumers and the economy will depend on many things: what a state includes in its plan, how that plan alters demand for electricity, how it affects infrastructure investment and power system operations, and so forth. Given the flexibility that EPA has afforded to the states in its proposed Clean Power Plan, the choices that states make in shaping their State Plans could (and no doubt will) have far-reaching implications not only for CO_2 emission reductions, but also for the cost of compliance. What those State Plans include also will affect the cost of electricity for the state's residents and businesses, and the overall impact of the program on the state's economic growth, employment, taxes and wages.

To illustrate the potential implications of program design and implementation, we have reviewed the experience of Northeast states in implementing RGGI, the nation's first CO_2 emission control program using a cap-and-trade approach. RGGI is now in its sixth year of operations. While it is a coordinated, multi-state market-based program for the control of CO_2 emissions from the power sector, the states' design for RGGI reserved a significant degree of implementation flexibility for each of the states participating in the program. From the outset, RGGI allowed each state to determine whether and how to allocate or auction emissions allowances to owners of power plants. Because the states implemented the program in various ways, the RGGI experience provides insights about the relationship between program design and outcomes for consumers and the economy.

In this section we summarize key elements of the RGGI program, discuss the findings and implications of a recent economic analysis of RGGI previously conducted by Analysis Group, review program design and spending changes implemented since the time of that prior report, and discuss implications for design considerations in the context of states' implementation of the proposed Clean Power Plan.

In focusing here on the RGGI story to illustrate how a multi-state, market-based approach has worked, we do not presume that other states would use this particular approach. We recognize that there are various other approaches that different states might use to align CO_2-emission reduction goals with electric system operations and distribution of benefits to consumers. RGGI's experience provides a workable example, from which other states can derive insights about how they might design approaches that work within their own electric-industry contexts.

RGGI Background and Overview

In 2009, ten Northeastern and Mid-Atlantic States began the Regional Greenhouse Gas Initiative as the country's first market-based program to reduce emissions of CO_2 from fossil-fueled power plants equal to or greater than 25 megawatts (MW) in size.[21] The concept underlying the design of RGGI was that the participating states could reduce power plant emissions most efficiently (that is, at lowest

[21] The ten states are Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. On May 26, 2011 New Jersey decided to withdraw from the RGGI program, and has not participated since the end of 2011.

cost) by introducing a price signal on carbon, and in so doing, cause the region's economic dispatch of power plants to reflect the cost of a tradable carbon-emission allowances along with the other more traditional variable costs of operating power plants (e.g., fuel, operations and maintenance).

Once the RGGI program was designed through a process involving state officials and industry participants over several years, each state that elected to join RGGI obtained authority to do so through its legislature and/or regulatory mechanisms. For example, RGGI developed a 'model rule' that outlined the core design elements of the program, and then each state adopted its own enabling authority to allow it to participate. This meant that the participating states did not need to adopt a formal interstate compact under federal law, while still allowing the participating states to establish a coordinated and common mechanism for incorporating a carbon price into their power-system dispatch and operations.

The program initially limited regional emissions to 188 million short tons of CO_2 annually across the then ten-state RGGI region. This regional cap was agreed-upon by the participating states and then apportioned to states based largely on CO_2 emissions from the affected sources, in accordance with state-specific allowance budgets that were agreed upon by the states.[22]

The region-wide cap on total CO_2 emissions is the only ceiling on emissions.[23] In other words, an annual pool of emission allowances was created in an amount equivalent to the regional cap, and each state received a share of allowances that the state could then allocate to market participants. Once the allowances moved from the states' hands into the market, actual emissions in a state could be higher or lower than that state's original allowance allocation, as long as the total emissions were consistent with the cap.

In order to comply, every affected power plant must to surrender an allowance for every ton of CO_2 emissions it emits over the three-year period. (This process occurs at the end of each three-year compliance period, with the first being for the 2009-2011 period.)

As originally designed, the cap would decline by 2.5 percent per year beginning in 2015, to reach an overall reduction of 10 percent of CO_2 emissions by 2018. The states were free to decide how each state's allowances would be distributed or sold into the hands of power plant owners. In theory, each state could issue them to power plant owners for free, or could sell them into the market, or some combination of both approaches.

Ultimately, however, each RGGI state voluntarily decided to distribute the vast majority of CO_2 emission allowances through a common, centralized auction administered by the organization set up by states to run the program (RGGI Inc.). As a result, the owners of affected power plants have obtained CO_2 allowances by purchasing them through the initial auctions (held quarterly), or by

[22] Thus, this would be different from a multi-state agreement where, under the proposed Clean Power Plan, the EPA established a CO_2-emissions-reduction target for each state, and then each cooperating state individually decided to: (a) coordinate its emissions reductions with other states, (b) convert its CO_2/MWh emission-rate target into an equivalent mass-based CO2 target (e.g., a CO_2 emission budget or cap for each state), and then (c) establish mechanisms through which it would formerly adopt elements in its State Plan to effectuate the common, coordinated and multi-state CO2-emission reduction program. We recognize that such an approach could work in the context of traditional investor-owned utilities that serve portions of several states and that operate as an integrated system, and/or in the context of multi-state competitive markets. See: Susan Tierney, "Greenhouse Gas Emission Reductions From Existing Power Plants Under Section 111(d) of the Clean Air Act: Options to Ensure Electric System Reliability," May 8, 2014.

[23] Under some circumstances, the regional cap could increase (i.e., if CO_2 allowance prices hit a particular dollar level, at which point the program would issue new allowances held in reserve for that purpose).

purchasing/transferring them in a secondary market once those allowances move into the system via the auction process.

Approximately 99 percent of allowances have been initially distributed via RGGI auctions. Participation in the auctions is open to any company or person meeting qualification requirements (e.g., financial security requirements), with a ceiling of 25 percent placed on purchases by a single buyer or group of affiliated buyers in each auction.

Proceeds from the quarterly auctions – which are determined by quantities sold and auction clearing price (subject to a reserve (floor) price) – are distributed to states, and states determine how to use the funds. Since the initial allowance auction took place at the end of 2008, and up through the most recent auction. As of June 4, 2014, total revenues from the sale of CO_2 allowances has amounted to $1.4 billion. (See Appendix 2.)

The proceeds from the quarterly auctions have flowed through to the individual states in proportion to each state's share of the cap.

The use of auction proceeds has varied across the states and over time, consistent with the enabling state legislation, regulation, and policy. Examples of how the states used their share of the RGGI funds include:

- investment in energy efficiency programs,
- a credit on each customer's electricity bills,
- funding of state government operations through allocation to state general funds,
- investment in community-based installation of renewable or advanced power generation systems,
- education and job training programs, and
- other greenhouse gas reduction initiatives.

Additionally, a small portion of the proceeds have supported administrative costs for the RGGI program. As explained further below, the vast majority of RGGI funds have been reinvested in energy efficiency in part to mitigate the impact of the program on wholesale electricity prices and consumer electricity costs.

Analysis of RGGI's Economic Impacts

In late 2011, we published a report examining, among other things, the consumer cost and economic impacts of RGGI's implementation over its first three years (the first compliance period from 2009-2011).[24] The purpose of that report was to review program implementation, quantify the impact of the program on wholesale electricity markets (power prices, emissions trends, operations), review the various ways in which states reinvested allowance auction proceeds, examine impacts on customers' electricity prices, and estimate the economic impacts of program implementation on each of the RGGI states. The AG RGGI Report was designed to evaluate program performance in order to provide insights and observations that could be useful in evaluating past policy decisions and in the development of future policy design changes.

[24] AG RGGI Report.

In that report, we tracked the path of RGGI-related dollars through the supply chain: we observed the payments that owners of affected units made to purchase CO_2 allowances and how those allowances affected the prices at which those power plant owners were willing to sell power. We examined the implications of those allowance prices on changes in the production costs of different types of power plants, and then on their dispatch. We observed the changes in allowance prices in the quarterly auctions, along with the amounts of auction proceeds that went to each state after each auction. We tracked how each state chose to spend those proceeds over time. Where states spent auction proceeds to implement energy efficiency, we examined the types of programs they supported and the impacts of those programs on the demand for electricity over time. Our analysis relied on actual data on allowance pricing, actual fossil fuel prices, revenues, state disbursement and expenditures.

Using a comprehensive power sector production-cost model (GE MAPS), we compared the electric system's demand, power plant dispatch, emissions, and overall cost first using the "real world" conditions which represented the "with RGGI" scenario. We compared it to a "without RGGI" scenario in which we backed out the price of emissions allowances and the effect of investments of RGGI dollars in energy efficiency and renewable energy, and identified how this changed power plant dispatch, production costs, and emissions. Taking the results of the "with RGGI" and "without RGGI" analyses, we then modeled the impacts on the states' economies by using the IMPLAN input/output model. That latter analysis also examined the implications for different states' economies of their choices to use the RGGI auction proceeds for energy efficiency versus general-fund support versus credits on customers' electricity bills and other uses.

Our analysis reached the following conclusions about the states' implementation of RGGI during its initial three years of operation:[25]

- RGGI produced in total $1.6 billion in net present economic value (NPV) for the ten-state region, representing on average approximately $33 per capita in net economic benefits (i.e., taking costs into consideration). The use of auction proceeds for public purposes (e.g., giving customers a credit on their electricity bill, paying for energy efficiency measures to help reduce consumers' electricity use and electricity bills) offset the modest increase in electricity prices associated with the RGGI program and led to myriad positive economic spillover effects. Examples included the increased purchasing power associated with lower electricity bills, the economic impacts of spending money to hire people to perform energy audits or install solar panels, and the benefits to businesses of increased sales of energy efficiency equipment). Our analysis reflected both direct spending benefits and indirect multiplier effects locally and regionally.
- The economic benefits resulted from the fact that when the states auctioned off the allowances (rather than giving them to power plant owners for free), the revenues from the program could be used for public benefit. This allowed states to retain associated revenues for public use, with outcomes that provided substantial fiscal, consumer, and environmental benefits. (Note that in the ten RGGI states, the electric industry was restructured over a decade ago, so that most power plants are not owned by electric utility companies. Had the states given away the allowances for free to the owners of power plants, the value of those allowances would have gone to the shareholders of those companies, rather than to consumers of electricity in competitive wholesale markets. This influenced the decisions of states to use an auction to move the allowances into the

[25] AG RGGI Report, pages 2-8.

hands of power plant owners, leaving the states with the opportunity to use the monetary value of those allowances for the public benefit.)

- Over the first three years, RGGI led to over 16,000 additional jobs (job-years) with each of the ten states showing net job additions. Jobs related to RGGI activities are located around the economy, with examples including engineers who perform efficiency audits, workers who install energy efficiency measures in commercial buildings, staff performing teacher training on energy issues, and other things.
- CO_2 allowances tended to increase electricity prices by less than 1 percent in the near term, but over time – as the RGGI states invested a substantial amount of the allowance proceeds on energy efficiency programs that led to lower electricity use – the program results in lower electricity prices and lower consumer payments for electricity. This resulted because the system avoided having to run some of the more expensive power plants, and thus lowered wholesale prices, plus consumers had lower electricity bills as demand went down. The analysis found reduced electricity expenditures equaling approximately $1.1 billion over a ten-year period, reflecting an average savings of $25 for residential consumers, $181 for commercial consumers, and $2,493 for industrial consumers. Consumers of natural gas and heating oil saved another $174 million, because some of the energy efficiency programs had the collateral effect of lowering use of those other heating services
- Although owners of fossil-fuel power plant owners raised their prices to reflect the cost of having had to purchase CO_2 emission allowances (and thus most of these owners ended up recovering at least some of their RGGI compliance costs), over time the market for their product (i.e., sales of electricity) ended up being lower than it would have been without RGGI, because of the states' use of auction proceeds to fund energy efficiency and lower demand. Also, among power plants, those with zero or low carbon emissions (such as renewable facilities or nuclear plants) received financial benefit for this attribute through revenues in electric energy markets.
- The scope of RGGI's positive economic benefits varied by state and region, with those states investing the heaviest in energy efficiency realizing significantly higher economic benefits.
- The form of CO_2 controls – namely, a market-based program – worked seamlessly within the Northeast's wholesale electricity market structures and produced relatively efficient compliance costs in those markets.
- The states' use of allowance proceeds not only provided economic benefits, but also helped them meet a wide variety of social, fiscal, and environmental policy goals, such as assisting low-income customers, achieving advanced energy policy goals, addressing state and municipal budget challenges, and restoring wetlands. Even so, how allowance proceeds were used strongly affected their economic impacts, with energy efficiency investment standing out as the use with the highest local economic benefits. For example, use of RGGI dollars to invest in energy efficiency ended up lowering regional electrical demand, lowering electricity prices, and lowering all consumers' payments for electricity (not just those who installed energy efficiency measures). These savings on electricity bills flowed through the economy as increased consumer disposable income (from fewer dollars spent on energy bills), lower payments to out-of-state energy suppliers, and increased local spending or savings.

RGGI helped the Northeast states lower total fossil-fired power production and lower use of natural gas and oil for heating, thereby reducing the total dollars sent out of state for energy resources.

RGGI Program Developments Since the 2011 AG RGGI Report

Since the time we concluded our analysis of the first three years of the RGGI program, it has continued to evolve in several ways.

For example, the states undertook a comprehensive program review in 2012, examining program success and impacts, the effects of imports and emissions leakage, the integrity of the offset program, and whether additional reductions beyond 2018 should be implemented. That program review was completed in February 2013, and involved a comprehensive assessment of program design issues, a modeling of potential future RGGI program levels, CO_2 allowance prices, impacts on electricity prices and customer bills, and the region's economy.[26]

Based on its review, the RGGI states made a number of technical changes and improvements designed to build on past experience and to strengthen the program moving forward, the most significant of which was the decision to reduce the 2014 regional CO_2 emission cap by 45 percent, from 165 million to 91 million tons, with an additional annual decline beyond that of 2.5 percent per year from 2015 to 2020.[27] The decision to reduce the cap reflected all states' positive association with program implementation and the environmental and economic benefits flowing from the program's first three years.

Overall, revenue generation through RGGI Auctions has remained strong, and states have continued to invest in ways that likely generate cost savings and economic benefits for residents and businesses. For example, in the initial period analyzed in the AG RGGI Report (2009 - 2011), RGGI collected and the states spent approximately $620 million through allowance sales, across all current RGGI states.[28] In just the subsequent two years, states have already collected and spent approximately $440 million, reflecting in particular an increase in allowance prices. See Figure 1.

[26] Program impacts were modeled under a fully vetted reference case as well as a number of key sensitivities related to natural gas prices, electricity demand, and changes to existing generation infrastructure.

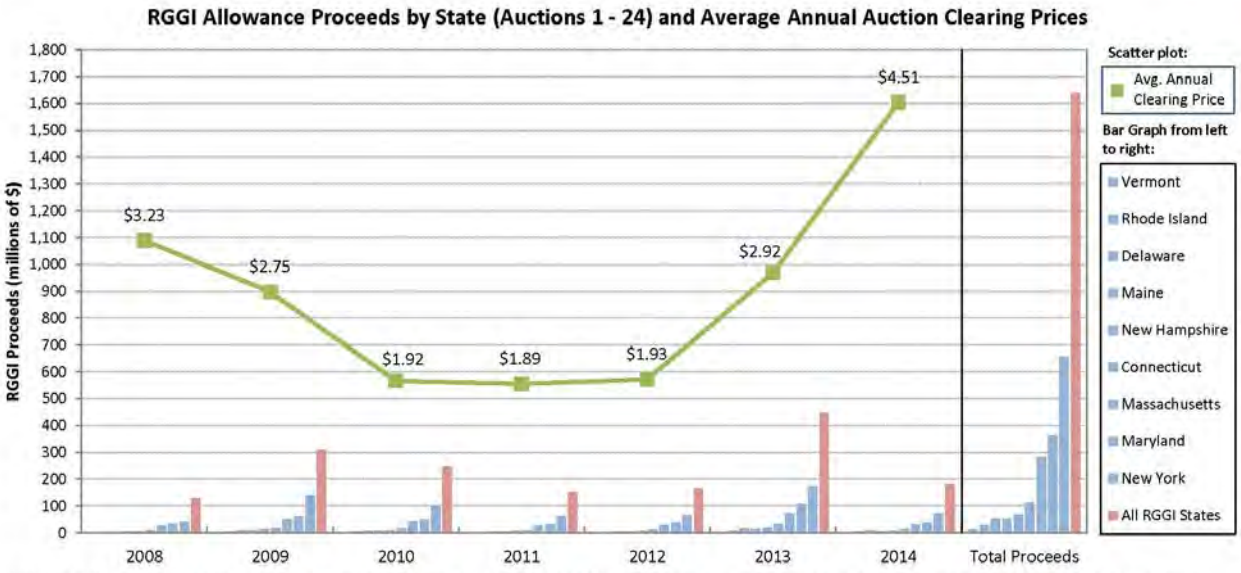
[27] Other changes included:

- Adjusting the CO_2 emissions cap to address the private bank of allowances held by participating entities, and the retirement of existing unsold 2012 and 2013 allowances;
- Instituting of a cost-containment reserve (CCR) of CO_2 allowances to help moderate price impacts, whereby CCR allowances would be made available for sale should the CO_2 allowance prices exceed certain pre-established price levels;
- Updating the RGGI offsets program, including a new forestry protocol;
- Requiring regulated entities to acquire and hold a portion of required allowances throughout each compliance period; and
- Committing to assessing tools to monitor for emissions associated with electricity imports and developing a mechanism to address such import emissions.

RGGI Inc., "RGGI States Propose Lowering Regional CO_2 Emissions Cap 45%, Implementing a More Flexible Cost-Control Mechanism," Press Release, February 7, 2013.

[28] For the purpose of consistency in our comparisons of the first and (to-date) second compliance periods, we exclude New Jersey from these values.

Figure 1



Notes: [1] Six states participated in the first auction (September 2008). [2] 2008 and 2014 values reflect proceeds from two auctions. Values for all other years reflect proceeds from four auctions.
Source: RGGI Inc.

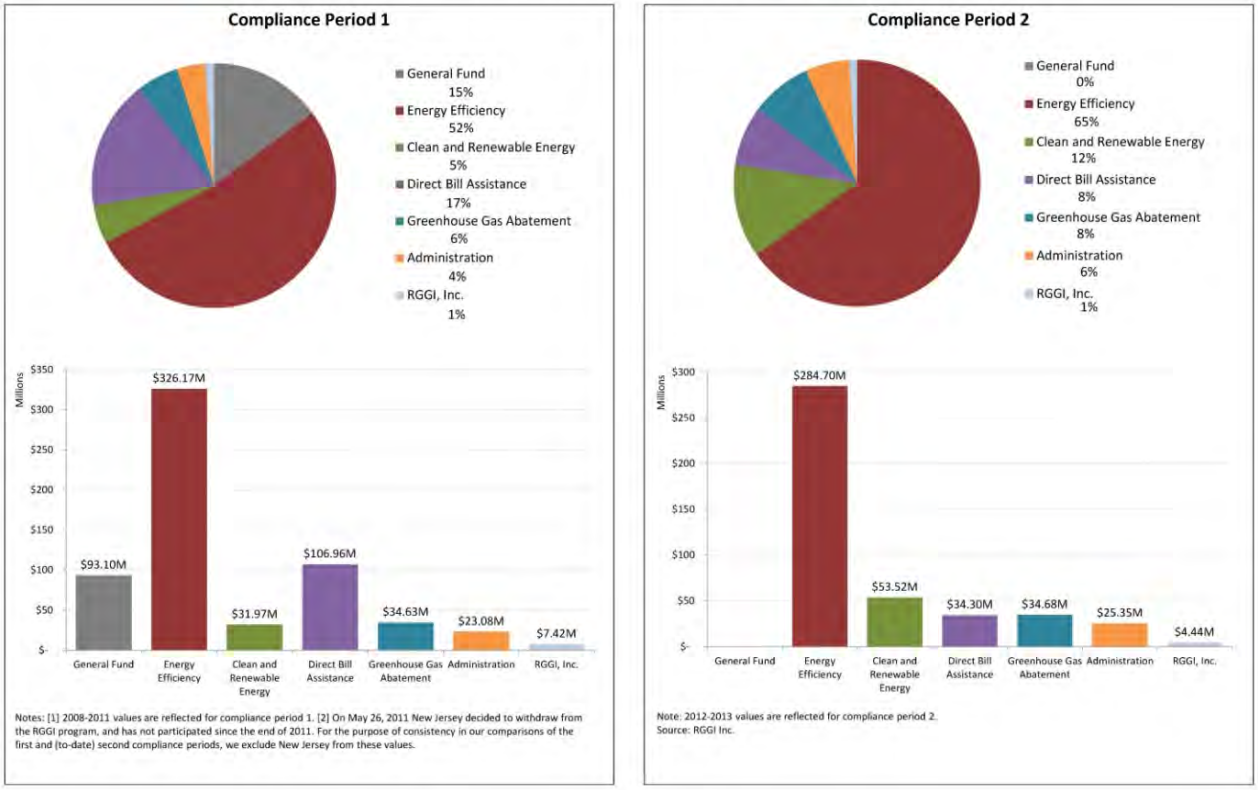
From 2009-2011 (Compliance Period 1), roughly half (52 percent) of allowance revenues across the region were invested in energy efficiency programs and measures. The other uses were: 17 percent for credits on electricity customers' electricity bills (and primarily low-income consumers); 15 percent used to offset state budget challenges; 11 percent for either clean and renewable energy investments or CO_2 mitigation measures; and 5 percent to cover program administrative costs. See Figure 2.

More recently (in 2012-2013), the RGGI states have spent more of their auction proceeds on energy efficiency. Based on the insights we gained from the prior AG Study, we think that this will increase the overall economic benefits of the RGGI program. Based on those two most recent years (2012 and 2013), there has been a 25-percent increase in states' spending on energy efficiency (most recently at 68 percent of the total auction revenues of approximately $440 million), with additional increases in spending on clean and renewable energy (12 percent) and greenhouse gas abatement (8 percent), and no use of auction revenues for contribution to states' general funds.[29] See Figure 2.

[29] Charts and values for all states' spending in Compliance Period 1 and Compliance Period 2 (to-date) are contained in Appendix 1.

Figure 2

All RGGI States Proceed Spending (Excluding NJ)



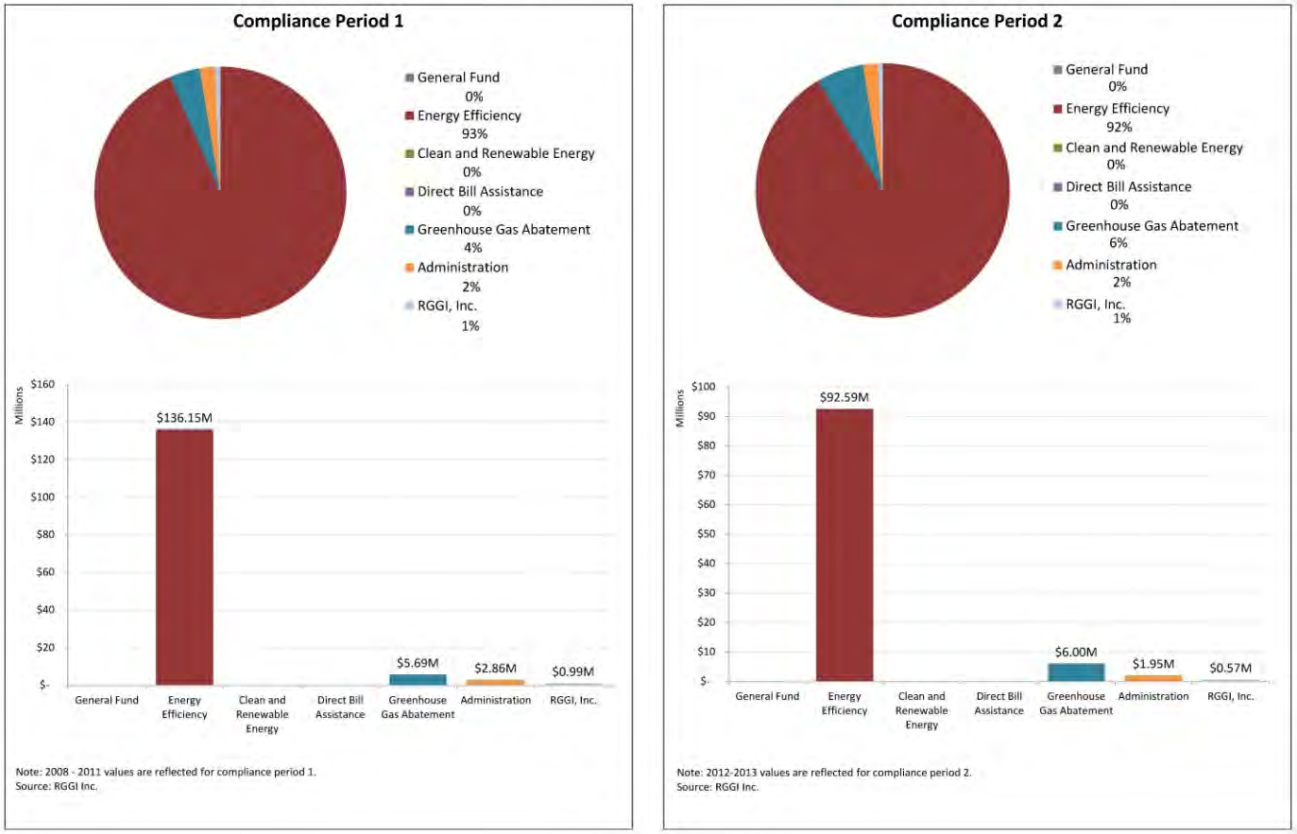
Across the RGGI region, about half of funds went to energy efficiency during first three years of the RGGI program (i.e., in Compliance Period 1). But in some states (especially in New England), virtually all allowance proceeds were spent in that category. For example, Massachusetts spent approximately 93 percent of auction revenues on energy efficiency in the first Compliance Period, and has essentially maintained that level of energy-efficiency spending over the past two years (92 percent). See Figure 3. For New England as a whole, Compliance Period 1 spending on energy efficiency amounted to approximately 89 percent of total auction revenues, with a similar level since that time (88 percent).

These factors had important implications for the level of state economic benefits derived from RGGI program implementation. We found that level of economic benefits (net economic value added, and jobs) per dollar of auction revenue spent was highest in those states in regions with the greatest level of reinvestment of auction proceeds on energy efficiency.

Therefore, all else equal, the recent trend in the second Compliance Period (2012-2013) towards use of auction proceeds for energy efficiency investment will lead to *increased* economic benefits across the RGGI states.

Figure 3

Massachusetts RGGI Proceed Spending



Implications for Clean Power Plan Compliance

The RGGI experience may provide important insights as states develop their State Plans and consider alternative compliance approaches. EPA's Clean Power Plan invites states to explore market-based mechanisms and to attempt to participate in multi-state CO_2 reduction programs. One option for the states that now participate in RGGI would be to include this program as part of their State Plans.[30] In addition, other states could elect to join RGGI (with corresponding changes in the cap and the state budget allocations). Other states may elect to set up a single-state cap-and-trade program or establish a new one in concert with other states. Some states served by electric-utility affiliates of a single holding company could establish a cap on the emissions of that company's power plants in the several states, and then allow it to operate its power plants (as now) as an integrated system, allowing the company to dispatch its plants economically with also taking system security as well as carbon emissions into account.

Insights from the RGGI experience are relevant for other states as they consider market-based approaches. But there are wider lessons for other approaches, as well. There are a number of

[30] We expect that the RGGI states would need to make technical changes in the RGGI program design, once the final Clean Power Plan is adopted by EPA, if some aspects of RGGI would not otherwise meet EPA's requirements (e.g., as to the level of the cap, or the existence of a cost-containment mechanism that allows electric companies to purchase more allowances if prices hit a particular ceiling price).

potential additional compliance approaches and mechanisms suggested by EPA (or that states might develop on their own) that could involve the investment of compliance fees or charges on affected units that could operate in ways akin to market-based mechanisms. States can look at the RGGI experience to inform their own choices regarding these various ways to introduce some sort of real or shadow prices on carbon emissions from power plants.

We note, for example, the a number of observations, based on our review of the economic impacts of the RGGI program and our research on ratemaking policies of states:

- Market-based mechanisms offer important opportunities to minimize costs while also reducing CO_2 emissions from existing power plants.
- States can implement such market-based programs within state boundaries.
- Moreover, states can work together – and with the stakeholders within each state – to develop and implement workable multi-state programs to control CO_2 emissions from existing power plants, in ways that fully preserve the rights of each state.
- Such multi-state, market-based mechanisms to control CO_2 emissions can respect the practicalities of electric system operations, and can be seamless integrated into both traditionally regulated and competitive electric industry settings.
- States with vertically integrated utilities have other tools, including integrated resource planning processes, for identifying least-cost compliance strategies.
- Pricing carbon will help send efficient signals for new investment in resources (like zero-carbon technologies such as renewables, hydro facilities, and nuclear power plants, and in deeper energy efficiency measures) and for shifting power system operations toward power plants with lower carbon emissions. This result is likely true whether pricing carbon is accomplished through a market-based mechanism like RGGI or alternative compliance mechanisms.
- Market-based mechanisms – like RGGI or California's cap-and-trade program – can also provide opportunities for states to capture the economic value of CO_2 emission allowances and direct those revenues for public and social benefit. In states with restructured electricity markets, states may choose to rely on methods to move CO_2 emission allowances into the market that avoid windfalls to owners of power plants. For the RGGI states, this has been accomplished through auctioning of CO_2 allowances. In other states (whether they have a traditional utility industry or a restructured market), another competitively neutral way to provide public/consumer benefits would be to allocate allowances for free to electric distribution utilities, who then can sell them to power generators and capture the revenues for consumers.[31]
- Including cost-effective energy-efficiency programs as part of states' CO_2 compliance strategies can help deliver significant benefits to customers and to local economies. The RGGI states have used the proceeds from selling CO_2 allowances to produce such benefits while offsetting compliance costs. Many other states have experience in using energy efficiency as part of a least-cost utility resource plan. As electricity prices tend to rise with CO_2 compliance, states should

[31] See, for example, Conrad Schneider, "Power Switch: An Effective, Affordable Approach to Reducing Carbon Pollution from Existing Fossil-Fueled Power Plants," Clean Air Task Force, February, 2014, with accompanying technical analysis by Bruce Phillips, " Alternative Approaches for Regulating Greenhouse Gas Emissions from Existing Power Plants under the Clean Air Act: Practical Pathways to Meaningful Reductions," The NorthBridge Group, February 2014.

expect to see more opportunities for cost-effective energy efficiency – and can use ratemaking tools to create financial incentives for utilities to pursue them.

No matter what set of approaches a state considers including in its State Plan, state utility regulators will be in a position to weigh the cost implications of various programs and do what they can to encourage efficient and least-cost compliance options so as to minimize impacts on electricity consumers. This is discussed in Section 5, below.

5. FAIRNESS AND PROTECTION OF CONSUMERS

Overview

We know that potential electricity price impacts from the EPA's proposed Clean Power Plan will be the subject of intense attention: electricity costs can affect the competitiveness of businesses, particularly those engaged in energy-intensive activities, with implications for economic output and jobs. Increases and decreases in electricity rates and costs affect the disposable income of all residents, with ramifications tied to quality of life, ability to meet other financial obligations, and the degree of spending in the general economy. Lower-income individuals spend a disproportionate share of annual income on energy costs, and any increases in electricity costs to those customers can create genuine hardship, drawing away income that is otherwise needed for other basic necessities, and cost increases often lead to an increase in uncollected revenues for utilities.

Although there is not a direct relationship between program compliance costs and impacts on consumers' payments for electricity, it is still important to consider ways to minimize costs and protect consumers as much as possible from potential price increases. Careful attention to this issue can positively influence the design and implementation of State Plans. The lessons learned from the states' experience with RGGI program, for example, illustrate how the design and operations of that CO_2 reduction program led to net benefits for electricity customers and for those states' economies.

But state planning for implementation of CO_2 emission-control plans should not (and likely will not) stop with State Plan design. States can also use their long-standing experience in utility ratemaking principles and practices to ensure that the costs and benefits of CO_2 program compliance are distributed fairly among different types of customers. State can take steps to ensure that, to the maximum extent feasible, that compliance costs are minimized and that lower-income customers, in particular, are protected fairly.

In this context, states already have the tools to address and fairly manage the distribution of compliance program costs and benefits among customers. These tools are a standard part of ratemaking by state regulators around the country. We review these tools here, to remind states that in the end, these ratemaking issues will be part of how they roll out implementation of CO_2-control programs affecting their power industry and electricity consumers in their states.

In this section, we provide a brief overview of the legal and/or regulatory foundation for setting electricity rates, and consider how and to what extent public utility commissions (PUC) appear to manage investments in (and benefits of) energy efficiency programs and measures in that context. Second, we review how the federal government, states, and PUCs consider the specific challenges faced by lower-income consumers.

Our review of these issues is based on our prior experience and research into utility ratemaking, an understanding of relevant precedent and policies in most U.S. states, and the preparation of case studies for about half of the states in the U.S. The specific states

on which we focused (shown in shading on the map to the right) represent a diverse cross-section of states by geography (covering virtually every region of the U.S.), by electric industry structures (competitive, investor-owned utilities, municipal electric utilities, and electric cooperatives), by type of local economy (e.g., industrial, rural), and by power plant mix (e.g., dominated by coal, or gas, or hydro/nuclear, or more of a mix). We summarize our research and findings here, and include the individual state case studies in Appendix 4.

Electric Ratemaking to Allocate Costs and Benefits "Fairly and Equitably" (with a focus on energy efficiency programs)

Electric customers will pay for some of the costs of CO_2 compliance in a number of ways that are overseen by state utility regulators and/or boards of public power utilities. For example:

- In states where the utility owns fossil-fuel power plants directly affected by the proposed EPA Clean Power Plan and where consumers pay a 'bundled' price for power, consumers' rates will reflect the utility's compliance costs (as approved by state regulators/utility boards and consistent with least-cost ratemaking principles). States in this category include much of the Western states, the Plains states and Upper Midwest, the Southeast.
- In states with a restructured electric industry (e.g., Texas, Illinois, Ohio, the MidAtlantic and Northeast states), electricity customers that obtain power supply through default service offered by the distribution utility will pay electricity prices that reflect CO_2 compliance costs included in competitive power supplier purchases in wholesale electricity markets, which are regulated by the Federal Energy Regulatory Commission and to some degree are influenced by local state policies (e.g., for renewable energy).
- In states that choose to include energy efficiency as part of a State Plan, state PUCs (and in some instances, state efficiency providers) will play an important role in those programs.

In most states, utility regulators endeavor to set utility rates in a manner that allocates costs to those customers whose usage patterns cause the costs to be incurred in the first place. For example, customers whose usage tends to increase during peak periods when relatively expensive power-production costs occur tend to end up having rates that reflect those peaking power costs. Relatively arcane but important ratemaking methodologies to align rates with costs are the bread-and-butter of regulators' ratemaking work.

Through general rate cases and other ratemaking proceedings, PUCs routinely evaluate utility investments and expenses, determine what portion of these should be borne by shareholders and what portion by customers, allocate such costs in a manner that approximates cost incurrence, and design the resulting rates so as to recover approved costs in a way that encourage efficiency in utility operations and management of costs.

The obligation of PUCs to fairly and equitably allocate investments and expenses of regulated utilities is typically encoded in law, regulations, policies, and/or judicial precedent. Guidance is sometimes prescriptive, and other times general, but for many decades public utility regulation has followed the obligation to allocate costs and benefits in a manner that follows this concept, often phrased as "fair and equitable," "not unduly preferential," "just and reasonable," "non-discriminatory," etc. Table 1 provides a sampling of legal or regulatory language included in the statutes and/or decisions of state PUCs. Appendix 4 contains more detailed summaries for the states included in our case studies.

Table 1

Summary of State Ratemaking Practices that Address Consumer Impact Equity and Fairness

State	Bill or Recent Rate Case	Description
California	Public Utilities Code, Division 1, Part 1, Chapter 4, 739.6	"The commission shall establish rates using cost allocation principles that fairly and reasonably assign to different customer classes the costs of providing service to those customer classes, consistent with the policies of affordability and conservation."
Florida	Florida Statute Title XXVII, §§366.03	"In fixing fair, just, and reasonable rates for each customer class, the commission shall, to the extent practicable, consider the cost of providing service to the class, as well as the rate history, value of service, and experience of the public utility; the consumption and load characteristics of the various classes of customers; and public acceptance of rate structures."
Illinois	Illinois Statute 220 ILCS 5/1-102	"… the health, welfare and prosperity of all Illinois citizens require the provision of adequate, efficient, reliable, environmentally safe and least-cost public utility services at prices which accurately reflect the long-term cost of such services and which are equitable to all citizens" and that "variation in costs by customer class and time of use is taken into consideration in authorizing rates for each class."
Iowa	State of Iowa RPU-2013-0004 (Order Issued March 17, 2014)	Explaining a subrule related to new service, notes the provision "..is designed to insure that no customer receives any 'entitlement' to currently existing facilities, and that all customers pay their appropriate share of the utility's cost."
Massachusetts	Rate Case Order - Docket 11-01 (Dated August 1, 2011);	"The rate structure for each rate class is a function of the cost of serving that rate class and how rates are designed to recover the cost to serve that rate class. The Department has determined that the goals of designing utility rate structures are to achieve efficiency and simplicity as well as to ensure continuity of rates, fairness between rate classes, and corporate earnings stability."
Minnesota	Minnesota Statute § 216B.03	"Every rate made, demanded, or received by any public utility, or by any two or more public utilities jointly, shall be just and reasonable. Rates shall not be unreasonably preferential, unreasonably prejudicial, or discriminatory, but shall be sufficient, equitable, and consistent in application to a class of consumers."
New Mexico	NMSA 1978, §62-8-1	"Every rate made, demanded or received by any public utility shall be just and reasonable."
North Carolina	§62-1 and §62-133.8 Subs. h-4	"To provide just and reasonable rates and charges for public utility services without unjust discrimination, undue preferences or advantages..."
Texas	Chapter 25, Subchapter J, § 25.234 (effective July 5, 1999)	"Rates shall not be unreasonably preferential, prejudicial, or discriminatory, but shall be sufficient, equitable, and consistent in application to each class of customers, and shall be based on cost."

Specifically with respect to energy efficiency programs, PUCs typically consider fairness and equity considerations when approving utility spending on and collection of costs for energy efficiency programs and measures. However, although most states have some type of energy efficiency program operated by a utility (or a third-party energy efficiency entity, whose costs are paid for by electricity customers), ratemaking practices for "fairness and equity" in the design and implementation of energy-efficiency programs varies widely across the states. Typically, ratemaking and program design operate in parallel to assure a "fair and equitable" mix of energy efficiency programs and costs for different types of customers.

Table 2 presents for each state a breakdown of energy efficiency spending by rate class, compared to the overall level of revenues collected from rate classes to cover all utility costs. Appendix 3 contains a summary and state-specific charts showing energy efficiency spending and overall electric utility revenues by rate class.

We observe the following with respect to ratemaking practices and energy efficiency program design across the states:

- Most states have at least some experience with reviewing and approving expenditures for implementation of energy-efficiency programs and measures, across all rate classes, and many states have developed energy-efficiency programs and precedent over many years, even decades.
- In states with significant energy-efficiency expenditures, programs are implemented across all major customer classes.
- Across the country, the percentage of spending on energy efficiency is roughly equivalent to the breakdown of revenues collected from each customer class. As shown in Table 2, the average dollars spent on residential, commercial, and industrial rate classes for energy efficiency programs is roughly 46 percent, 40 percent, and 14 percent, respectively – which is close to the total revenues collected for overall utility service from each rate class (45 percent, 37 percent, and 18 percent, respectively).
- The types of energy-efficiency programs operated in a state vary across states. This may reflect, in part, that states have very different mixes and types of residential, commercial and industrial customers. It may also be due to the fact that in many states the energy savings benefits do not necessarily match the level of expenditures. For example, programs reaching large commercial and industrial customers may realize higher benefit/cost ratios than programs reaching smaller commercial and residential customers. In this case, the relative portion of total energy-efficiency spending may be smaller for large customers at the same time that total savings resulting from such spending are much higher.
- Even in states with a long history of having supported energy efficiency programs paid for in electricity customers' rates, PUCs are still finding that there are cost-effective opportunities to get further electric system savings. As electricity prices change over time, additional cost-effective energy-efficiency opportunities also increase.

.

Table 2

State Energy Efficiency Spending by Customer Class Compared to Revenues
2012

State	Residential	Commercial	Industrial	Total
Alabama	$9,172	$4,625	$24,131	$37,928
Alaska	$363	$148	$0	$511
Arizona	$65,678	$70,216	$409	$136,303
Arkansas	$18,670	$9,834	$40,696	$69,200
California	$488,578	$559,873	$144,861	$1,193,312
Colorado	$44,040	$67,717	$13,452	$125,209
Connecticut	$58,083	$47,665	$14,742	$120,490
Delaware	$1,860	$0	$0	$1,860
District of Columbia	$8,423	$8,760	$0	$17,183
Florida	$281,810	$100,270	$43,436	$425,516
Georgia	$30,794	$13,128	$11,344	$55,266
Hawaii	$2,328	$4,555	$185	$7,068
Idaho	$15,859	$15,734	$32,540	$64,133
Illinois	$78,368	$75,671	$2,658	$156,697
Indiana	$59,112	$20,475	$13,880	$93,467
Iowa	$45,851	$25,852	$51,943	$123,646
Kansas	$10,767	$3,427	$5,869	$20,063
Kentucky	$29,318	$8,358	$2,307	$39,983
Louisiana	$1,065	$3	$0	$1,068
Maine	$7,630	$9,356	$4,579	$21,565
Maryland	$161,184	$66,413	$280	$227,877
Massachusetts	$114,872	$74,881	$42,373	$232,126
Michigan	$71,543	$63,338	$11,008	$145,889
Minnesota	$78,367	$94,601	$52,695	$225,663
Mississippi	$3,725	$1,567	$5,052	$10,344
Missouri	$17,576	$16,020	$254	$33,850
Montana	$6,270	$9,112	$15	$15,397
Nebraska	$6,413	$7,197	$7,741	$21,351
Nevada	$20,013	$15,461	$0	$35,474
New Hampshire	$9,447	$10,888	$339	$20,674
New Jersey	$48,397	$12,867	$3,067	$64,331
New Mexico	$14,890	$10,501	$2,250	$27,641
New York	$116,235	$338,506	$31,836	$486,577
North Carolina	$84,693	$55,883	$12,510	$153,086
North Dakota	$8,263	$9,618	$1,998	$19,879
Ohio	$71,711	$56,782	$36,361	$164,854
Oklahoma	$26,155	$12,118	$1,866	$40,139
Oregon	$40,587	$49,355	$29,584	$119,526
Pennsylvania	$140,410	$89,219	$60,161	$289,790

State	Residential	Commercial	Industrial	Total
Rhode Island	$20,227	$18,740	$11,486	$50,453
South Carolina	$41,125	$19,832	$12,562	$73,519
South Dakota	$4,206	$1,701	$1,082	$6,989
Tennessee	$22,789	$15,544	$19,097	$57,430
Texas	$121,730	$78,628	$7,381	$207,739
Utah	$24,578	$14,708	$8,567	$47,853
Vermont	$14,474	$19,346	$0	$33,820
Virginia	$21,184	$6,614	$716	$28,514
Washington	$99,204	$85,276	$21,447	$205,927
West Virginia	$2,970	$2,749	$205	$5,924
Wisconsin	$40,351	$30,600	$46,831	$117,782
Wyoming	$1,784	$1,762	$1,288	$4,834
Average Spending (%)	**46%**	**40%**	**14%**	
Average Rate Class Revenues (%)	**45%**	**37%**	**18%**	

Notes & Sources:

[1] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed May 10, 2014.

[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

[3] "Average Spending (%)" shows the arithmetic mean of state percentages for EE revenues/costs by customer class.

[4] "Average Rate Class Revenues (%)" takes the sum of customer class revenues/costs from all states and divides by the total EE revenue/costs from all states.

Protecting Lower-Income Consumers

At least in the initial periods of CO_2-compliance programs, electricity prices are expected to increase slightly – with longer-term impacts reversing over time. (EPA's benefit/cost analysis estimates that "Average monthly electricity bills are anticipated to increase by roughly 3 percent in 2020, but decline by roughly 9 percent by 2030 because increased energy efficiency will lead to reduced usage."[32]) Even modest increases in electricity costs can have a disproportionate impact in the budgets of lower-income customers.

States have many tools to address cost impacts on lower-income customers, and have been using various approaches for many years. In Appendix 4, state summaries contain detailed descriptions of various programs to assist low-income customers, including the Low Income Home Energy Assistance Program (LIHEAP), the use of special discounted electricity rates for low-income customers, arrearage forgiveness and arrearage management plans, utility-sponsored charitable assistance programs, and dedicated funds for the targeted implementation of comprehensive electric and gas energy-efficiency programs in low-income residences.

Two important findings emerge from our review of the various commitments states have made to protect low-income customers: First, there is widespread application of low-income assistance across the country. There is broad reliance on the federal LIHEAP program across states, and virtually all states have various programs to help low-income customers with electricity costs. These will tend to dampen the impacts of CO_2 compliance costs on these consumers' electricity bills; in fact, in some states the existence of capped rates for low-income customers could limit or even eliminate the effect of any potential compliance cost increases on low-income customers.

Second, among the states, there are various 'best-practice' low-income assistance approaches. States can draw lessons from each other's practices to design and administer programs to protect lower-income consumers. Examples drawn from the states included in Appendix 4 include the following:

- *LIHEAP Funding* for heating and utility bill assistance, and low-income home weatherization, administered by states with federal funding, at times supplemented with separate state funding;
- *Low-Income Rates*, providing fixed discounts or caps on the rates that may be charged eligible low-income customers;
- *Dedicated Funding for Low-Income Energy Efficiency Programs*, requiring utility spends or minimum contributions to the installation of energy-efficiency programs and measures in the building units or residences of low-income customers;
- *Arrearage Management*, providing for discounting, contributions towards, or elimination of utility bill amounts in arrears for customers meeting minimum program requirements (such as making installment payments or staying current on bills going forward);
- *Utility-Driven Charitable Contribution Programs*, encouraging contributions through utility bill stuffers to funds that help low-income customers pay energy bills;
- *Disconnect/shut-off Protection*, whereby PUCs require extensive processes be followed by utilities before low-income customers may be disconnected for lack of bill payment; and

[32] EPA RIA, page ES-24.

- *Miscellaneous One-Time or Emergency Assistance Programs* instituted by states to help low-income customers maintain energy services, pay bills, or otherwise acquire service.

State Tools to Manage Potential Program Cost Impacts

States have various traditional ratemaking tools that will help them allocate costs related to CO_2 compliance in fair and equitable ways among customer classes. Additionally, states have considerable experience in designing energy efficiency programs to align program support with program benefits. Finally, states have deep experience in designing and using various mechanisms to protect lower-income customers.

States are well equipped through long-standing application of ratemaking principles and practices governing cost allocation fairness and equity, the pursuit of widely-distributed benefits from energy efficiency program implementation, and a comprehensive and diverse set of programs and policies recognizing and addressing the disproportionate impact of energy costs on low-income customers.

6. CONCLUSION

On June 2, 2014, the EPA released proposed rules to reduce emissions of CO_2 from existing fossil power plants. EPA's Clean Power Plan would require significant reductions in CO_2 emissions from the power sector, while also providing each state the flexibility to determine its preferred way to comply with the new requirements.

The costs associated with EPA's Clean Power Plan will likely be the focus of intense discussion in the coming months. EPA's analysis indicates that although there will be costs to comply with the Clean Power Plan, such costs will be much lower than the benefits to public health and to the overall economy from lower CO_2 and other air emissions. Yet others are suggesting that costs will outweigh benefits.

Clearly, State Plans approved by the EPA will create the framework for the industry's compliance with EPA's Clean Power Plan. How compliance plans are designed by the states will strongly affect the magnitude and distribution of costs and benefits among consumers, power plant owners, and the general economy. Regulatory practices for passing on costs to electricity consumers are also important, as they can influence the degree and allocation of program costs and benefits.

Based on our analysis and experience, we believe that the impacts on electricity rates from well-designed CO_2-pollution control programs will be modest in the near term, and can be accompanied by long-term benefits in the form of lower electricity bills and positive economic value to states' and regional economies.

We base our findings on the analysis conducted for this Report, in which we review the experience and expertise states have to prepare State Plans with a focus on lowering overall compliance costs and maximizing program economic benefits to consumers and to the states' economies.

There are sound reasons to be confident that customers will benefit from states' plans to lower the carbon intensity of their electric systems. First, and foremost, states have a long track record of using various regulatory and other policy tools to encourage utility programs and investments that minimize the cost of electric service, consistent with the myriad of public policies (tax, environmental, reliability, labor, and other areas of policy that affect the provision of electricity).

Second, under the proposed Clean Power Plan, states will have the flexibility, experience and tools to prepare and implement State Plans that fit their circumstances, minimize costs of compliance, and provide benefits to customers. Although states differ in many ways – including in terms of the electric systems, their regulatory culture, and their electric industry structure –all states have programs, policies and practices that will allow them to develop plans that align well with their different circumstances

Third, market-based mechanisms offer unique opportunities to minimize costs while also reducing CO_2 emissions from existing power plants. They can be done within a state or across a number of states. Pricing carbon in this way sends efficient, market-based signals for investment and operation of the electric system. Experience shows that such programs can be designed to achieve a number of state policy objectives, can lower electricity bills, and can deliver positive net economic benefits.

Fourth, states are well equipped through long-standing utility ratemaking principles and practices and implementation of energy programs to help protect low-income customers when electricity costs increase. Such tools include low-income rates and arrearage management plans, dedicated funding for low-income energy-efficiency and weatherization programs, utility-driven charitable contribution

programs, one-time emergency assistance programs, LIHEAP funding for heating and utility bill assistance, and disconnect/shut-off protection policies.

In the end, the states are in control. State energy, environmental and utility regulatory agencies will tailor compliance approaches to their individual circumstances, and in doing so will play a significant role in driving down and managing the costs of Clean Power Plan compliance through their plans. Those State Plans will define the set of actions that will work together to reduce emissions from fossil power plants. The components of the State Plans will affect compliance costs and collateral benefits. And states' regulatory and ratemaking policies can influence how compliance actions undertaken by owners of power plants and other actors translate into increases or decreases in electricity rates and bills to different types of consumers.

We are confident that, based on a long history of state policymaking focused on similar issues, and on the experience states have with a number of tools directly relevant to the task, states will successfully and fairly navigate implementation of EPA's Clean Power Plan.

APPENDICES

1. **EPA's Proposed Clean Power Plan**
2. **State Spending of RGGI Auction Proceeds**
3. **State-Specific Data on Electricity Revenues and Energy Efficiency Spending**
4. **State Case Study Summaries**

APPENDIX 1

EPA's Proposed Clean Power Plan

On June 2, 2014, EPA announced its proposed "Carbon Pollution Emission Guidelines for Existing Stationary Source: Electric Utility Generating Units" (or the Clean Power Plan) to reduce emissions from the power sector by 30 percent by 2030, when compared to emissions in 2005. The proposed regulation would reduce emissions from existing fossil-fuel power plants in the U.S.

On June 18, 2014, the U.S. EPA published its proposed rule to regulate carbon emissions from existing power plants in the Federal Register. This publication officially commenced a 120-day comment period on EPA's proposed rule.

The proposal will be implemented through a state-federal partnership that is designed to provide each state with flexibility in meeting its specific goal. Under the partnership, EPA identifies a target level of emission reductions from power plants located in each state, and the states identify (in State Plans) their preferred path for controlling emissions in their state.

EPA's proposal establishes each state's emission reduction goals in two parts – an interim "reasonable progress" goal that states must meet on average over the ten-year period from 2020-2029, and a final goal that states must meet at the end of that period, by 2030. The ultimate 2030 standard is estimated to achieve CO_2 emissions reductions from the power sector of 30 percent from CO_2 emissions levels in 2005.

Each state's goal is a rate for the future carbon intensity of that state, expressed in pounds of CO_2 per MWh. The EPA established a emission-reduction targets for each state using a methodology designed to reflect each state's potential to reduce emissions, based on four "building blocks":

- Reducing the carbon intensity of generation at individual affected EGUs through heat rate improvements;
- Reducing emissions from the most carbon-intensive affected EGUs in the amount that results from substituting generation at those EGUs with generation from less carbon-intensive affected EGUs (including NGCC units under construction);
- Reducing emissions from affected EGUs in the amount that results from substituting generation at those EGUs with expanded low- or zero-carbon generation; and
- Reducing emissions from affected EGUs in the amount that results from the use of demand-side energy efficiency that reduces the amount of generation required.

The emission intensity rate recognizes that CO_2 emissions are a function of both how efficiently they operate and how much they operate, and is calculated using a formula focused on four potential CO_2 emission reduction strategies, and state data related to each. EPA has requested comment on its approach, and in particular whether all four strategies should be considered, or just the first two.

The proposed rule would require states to submit State Plans to propose the combination of actions that the state and/or owners of affected power plants will take to reduce emissions. EPA has provided states a wide degree of flexibility in determining appropriate compliance pathways, taking into

consideration state-specific circumstances, opportunities, and objectives. Moreover, EPA will allow states to work individually or in groups, in order to capture potential opportunities for improved compliance efficiency and innovation, lower costs, and increased reliability.

EPA identified in its proposal – by way of example, not limitation – a number of measures states can choose to rely on in their State Plans, including:

- demand-side energy efficiency programs
- renewable energy standards
- efficiency improvements at plants
- co-firing or switching to natural gas
- transmission efficiency improvements
- energy storage technology
- retirements
- expanding renewables or nuclear
- market-based trading programs
- energy conservation programs

In addition to opening the door for states to work together on compliance, EPA has proposed to give states the option to convert the rate-based goal to a mass-based goal if they choose to in their State Plans. Adopting a mass-based goal would thus allow a state or group of states to cap their resulting quantity of CO_2 emissions and establish a joint trading program. This could allow states with existing cap-and-trade programs (such as California, or the current RGGI states) to adopt compliance strategies that rely upon a structure similar to the existing program. Moreover, it would allow other states to establish cap and trade programs, or join an existing one.

EPA's proposed schedule for filing and compliance would require submission of State Plans by June 30, 2016, with an opportunity for one-year extension if needed, or a two-year extension if needed to establish a multi-state plan. Once established, states would need to report progress at least every two years leading up to 2030.

The EPA is proposing to evaluate and approve state plans based on four general criteria:

1. The inclusion of enforceable measures that reduce EGU CO_2 emissions;
2. A projected achievement of emission performance equivalent to the goals established by the EPA, on a timeline equivalent to that in the emission guidelines;
3. Assurance that emission reductions will be quantifiable and verifiable; and
4. The inclusion of a process for biennial reporting on plan implementation, progress toward achieving CO_2 goals, and implementation of corrective actions, if necessary.

In addition, each state plan must follow the EPA framework regulations in the Code of Federal Regulations (CFR) at 40 CFR 60.23. The specific proposed components of states plans are:

- Identification of affected entities;
- Description of plan approach and geographic scope;
- Identification of state emission performance level;
- Demonstration that plan is projected to achieve emission performance level;
- Identification of emission standards;
- Demonstration that each emission standard is quantifiable, non-duplicative, permanent, verifiable, and enforceable;

- Identification of monitoring, reporting, and recordkeeping requirements;
- Description of state reporting;
- Identification of milestones;
- Identification of backstop measures;
- Certification of hearing on state plan; and
- Supporting material.

In its proposal, EPA describes how energy efficiency and renewable energy programs and investments could play a role in program compliance, and seeks comment on different approaches for providing such crediting or administrative adjustment of EGU CO_2 emissions rates for use of energy efficiency a compliance mechanism (as well as renewable energy or zero-carbon supply from nuclear power plants). EPA's proposal leaves the door open on energy efficiency as a compliance mechanism in the context of individual, portfolio, state-wide, or multi-state programs.

Key to the inclusion of energy efficiency as a compliance mechanism are mechanisms for monitoring and verification of energy savings, translation of savings into adjusted MWh or CO_2 emissions, and associated state reporting mechanisms. EPA has requested input on a number of factors related to the use of energy efficiency and renewable energy for compliance, and commits to the development of guidance documents related to these potential compliance mechanisms.

Finally, in its proposal and related documents, EPA reports on estimates of costs and benefits associated with program implementation under several options and scenarios related to compliance options, different regional and state approaches, and modeling sensitivities. As shown on "Table ES-10" from the EPA's Regulatory Impact Analysis (excerpted on the following page), EPA's estimates for 2030 implementation show significant net economic benefits. Additionally, EPA's analysis indicates that "Under Option 1 [which assumes states use a least-cost combination of the four building block strategies" in their State Plans], average nationwide retail electricity prices are projected to increase roughly 6 to 7 percent in 2020, and roughly 3 percent in 2030 (contiguous U.S.), compared to base case price estimates modeled for these same years. Average monthly electricity bills are anticipated to increase by roughly 3 percent in 2020, but decline by roughly 9 percent by 2030 because increased energy efficiency will lead to reduced usage." EPA RIA, page ES-24.

Table ES-10. Summary of Estimated Monetized Benefits, Compliance Costs, and Net Benefits for the Proposed Guidelines –2030 (billions of 2011$) [a]

	Option 1– state	
	3% Discount Rate	7% Discount Rate
Climate Benefits [b]		
5% discount rate		$9.5
3% discount rate		$31
2.5% discount rate		$44
95th percentile at 3% discount rate		$94
Air pollution health co-benefits [c]	$27 to $62	$24 to $56
Total Compliance Costs [d]		$8.8
Net Benefits [e]	$49 to $84	$46 to $79
Non-Monetized Benefits	Direct exposure to SO_2 and NO_2 2.1 tons of Hg and 590 tons of HCl Ecosystem effects Visibility impairment	

	Option 1– regional	
	3% Discount Rate	7% Discount Rate
Climate Benefits [b]		
5% discount rate		$9.3
3% discount rate		$30
2.5% discount rate		$44
95th percentile at 3% discount rate		$92
Air pollution health co-benefits [c]	$25 to $59	$23 to $54
Total Compliance Costs [d]		$7.3
Net Benefits [e]	$48 to $82	$46 to $77
Non-Monetized Benefits	Direct exposure to SO_2 and NO_2 1.7 tons of Hg and 580 tons of HCl Ecosystem effects Visibility impairment	

[a] All estimates are for 2030, and are rounded to two significant figures, so figures may not sum.

[b] The climate benefit estimates in this summary table reflect global impacts from CO_2 emission changes and do not account for changes in non-CO_2 GHG emissions. Also, different discount rates are applied to SCC than to the other estimates because CO_2 emissions are long-lived and subsequent damages occur over many years. The SCC estimates are year-specific and increase over time.

[c] The air pollution health co-benefits reflect reduced exposure to $PM_{2.5}$ and ozone associated with emission reductions of directly emitted $PM_{2.5}$, SO_2 and NO_X. The range reflects the use of concentration-response functions from different epidemiology studies. The reduction in premature fatalities each year accounts for over 90 percent of total monetized co-benefits from $PM_{2.5}$ and ozone. These models assume that all fine particles, regardless of their chemical composition, are equally potent in causing premature mortality because the scientific evidence is not yet sufficient to allow differentiation of effect estimates by particle type.

[d] Total social costs are approximated by the illustrative compliance costs which, in part, are estimated using the Integrated Planning Model for the proposed option and a discount rate of approximately 5%. This estimate also includes monitoring, recordkeeping, and reporting costs and demand side energy efficiency program and participant costs.

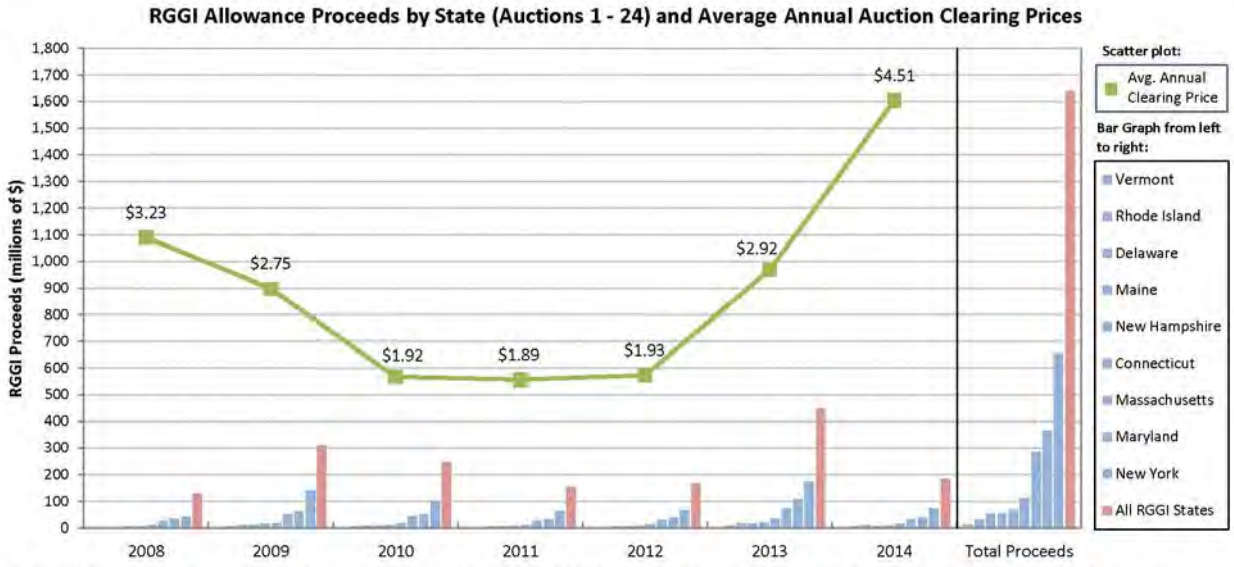
[e] The estimates of net benefits in this summary table are calculated using the global SCC at a 3 percent discount rate (model average). The RIA includes combined climate and health estimates based on these additional discount rates.

APPENDIX 2

State Spending of Regional Greenhouse Gas Initiative (RGGI) Auction Proceeds

Auctions 1-24 Proceeds Data								
State	2008	2009	2010	2011	2012	2013	2014	Total Proceeds
Vermont	$1,304,590	$2,347,481	$2,049,464	$1,265,682	$1,317,244	$3,366,456	$1,423,902	**$13,074,820**
Rhode Island	$2,830,092	$5,092,494	$4,417,622	$2,780,097	$2,857,539	$7,385,288	$5,116,476	**$30,479,609**
Delaware	$2,555,209	$8,943,843	$7,359,526	$5,040,617	$5,791,702	$16,193,082	$8,964,611	**$54,848,590**
Maine	$5,627,664	$9,618,944	$8,297,597	$5,195,051	$5,507,367	$14,064,063	$5,255,018	**$53,565,703**
New Hampshire	$4,020,882	$14,140,468	$10,053,925	$6,504,977	$7,732,377	$19,754,661	$7,582,304	**$69,789,594**
Connecticut	$8,852,819	$17,686,118	$18,361,644	$8,865,754	$11,401,369	$33,340,223	$14,004,231	**$112,512,156**
Massachusetts	$28,176,794	$50,918,303	$44,134,380	$27,161,704	$28,530,599	$73,955,401	$31,729,052	**$284,606,234**
Maryland	$34,389,987	$61,881,590	$51,258,785	$32,785,454	$38,799,832	$107,130,927	$38,074,172	**$364,320,747**
New York	$41,986,904	$138,691,813	$101,593,966	$62,606,377	$65,707,560	$172,779,777	$72,488,802	**$655,855,199**
All RGGI States	$129,744,941	$309,321,054	$247,526,909	$152,205,712	$167,645,590	$447,969,877	$184,638,568	**$1,639,052,651**

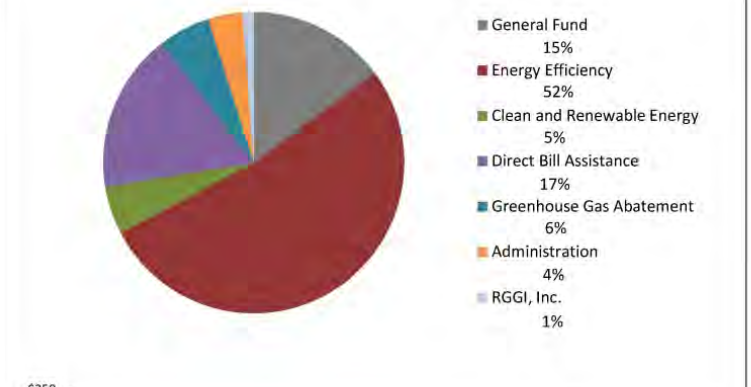
Notes: [1] Six states participated in the first auction (September 2008). [2] 2008 and 2014 values reflect proceeds from two auctions. Values for all other years reflect proceeds from four auctions.
Source: RGGI Inc.

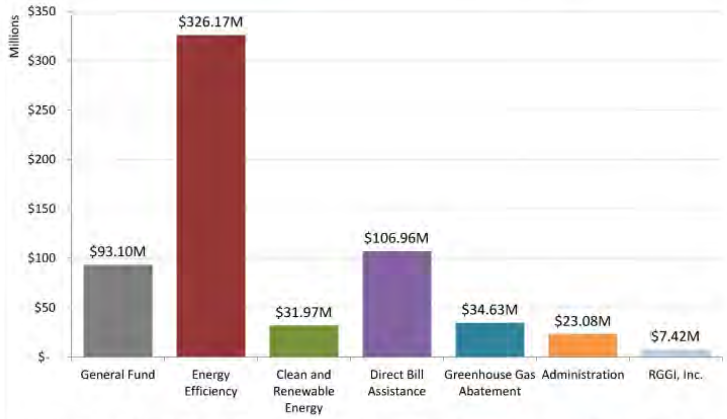


Notes: [1] Six states participated in the first auction (September 2008). [2] 2008 and 2014 values reflect proceeds from two auctions. Values for all other years reflect proceeds from four auctions.
Source: RGGI Inc.

All RGGI States Proceed Spending (Excluding NJ)

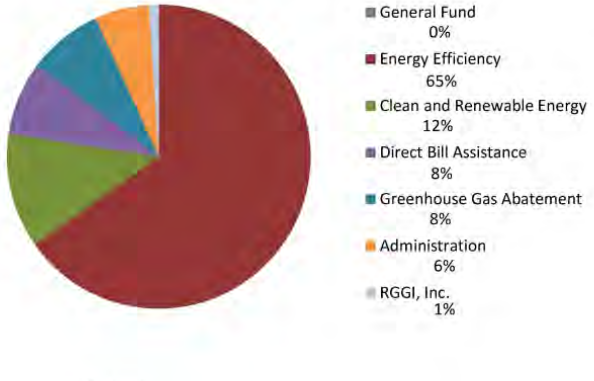
Compliance Period 1

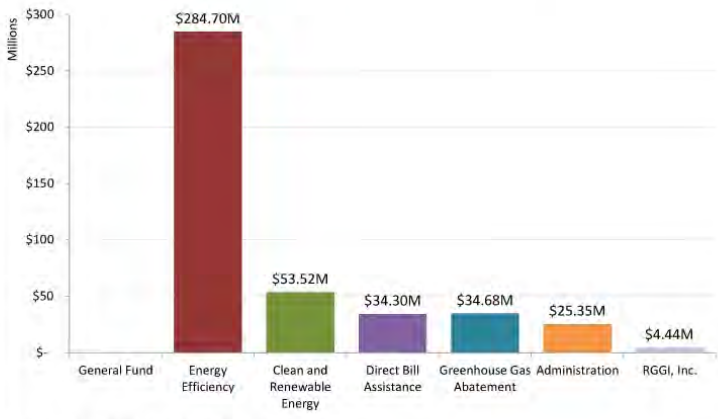




Notes: [1] 2008-2011 values are reflected for compliance period 1. [2] On May 26, 2011 New Jersey decided to withdraw from the RGGI program, and has not participated since the end of 2011. For the purpose of consistency in our comparisons of the first and (to-date) second compliance periods, we exclude New Jersey from these values
Source: RGGI Inc.

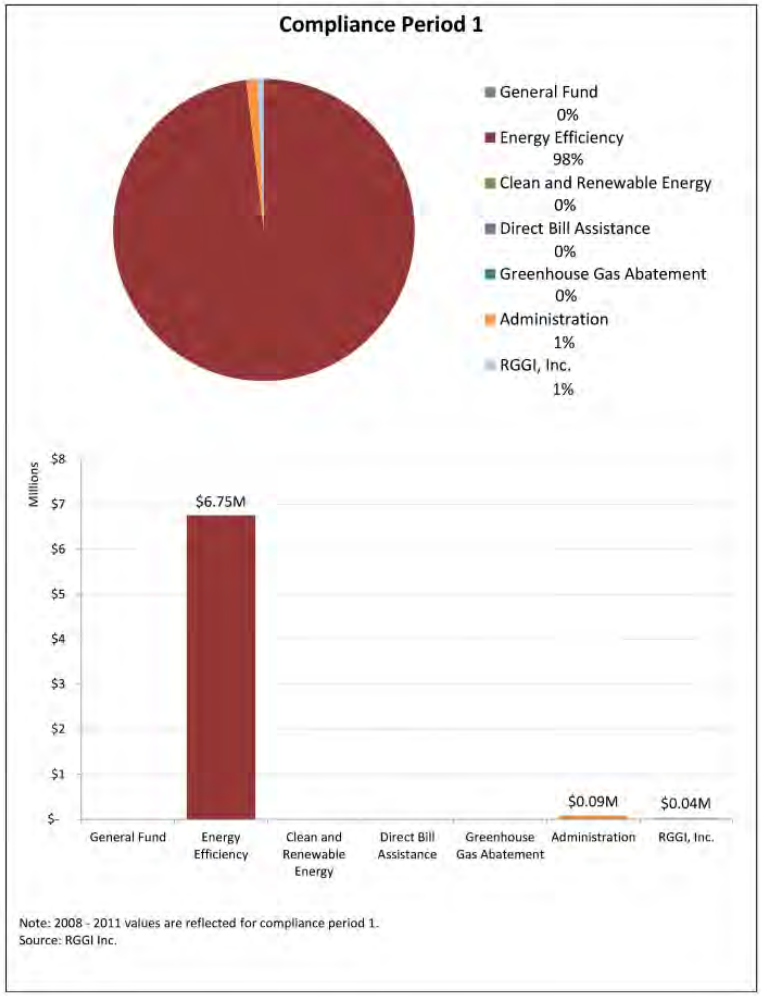
Compliance Period 2

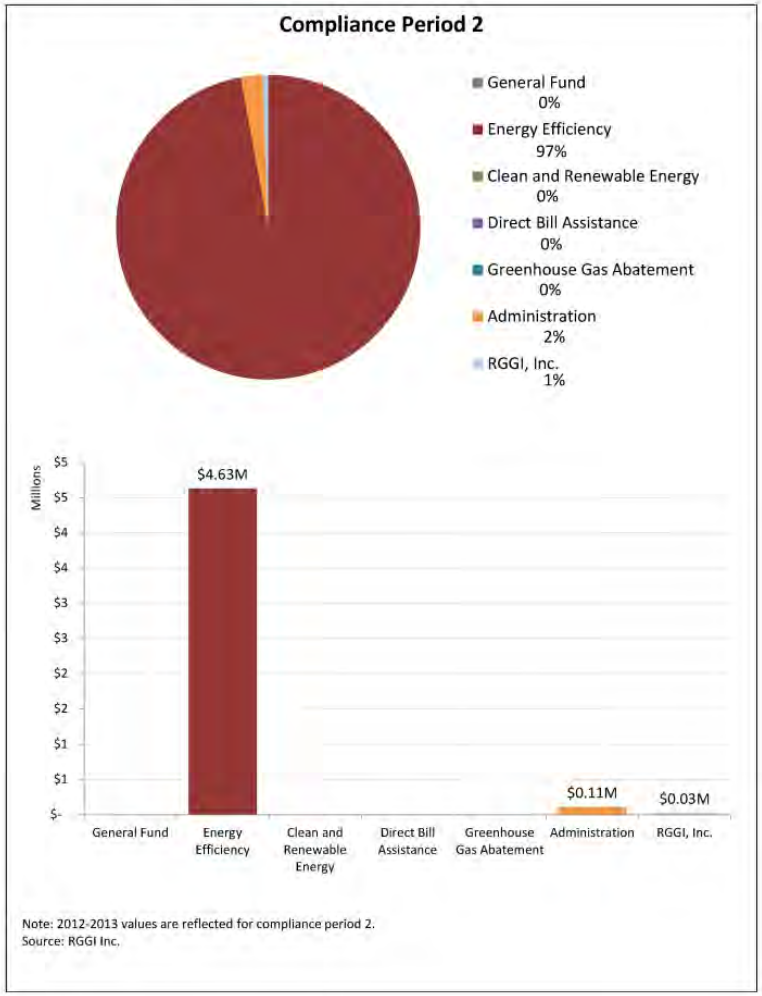




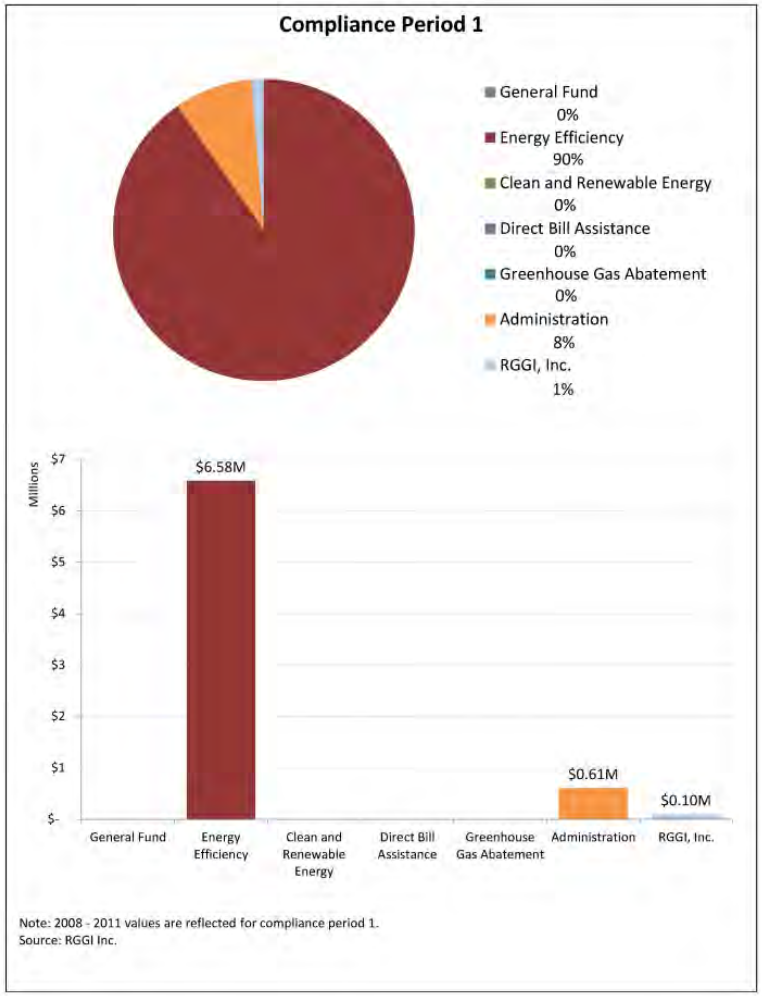
Note: 2012-2013 values are reflected for compliance period 2.
Source: RGGI Inc.

Vermont RGGI Proceed Spending

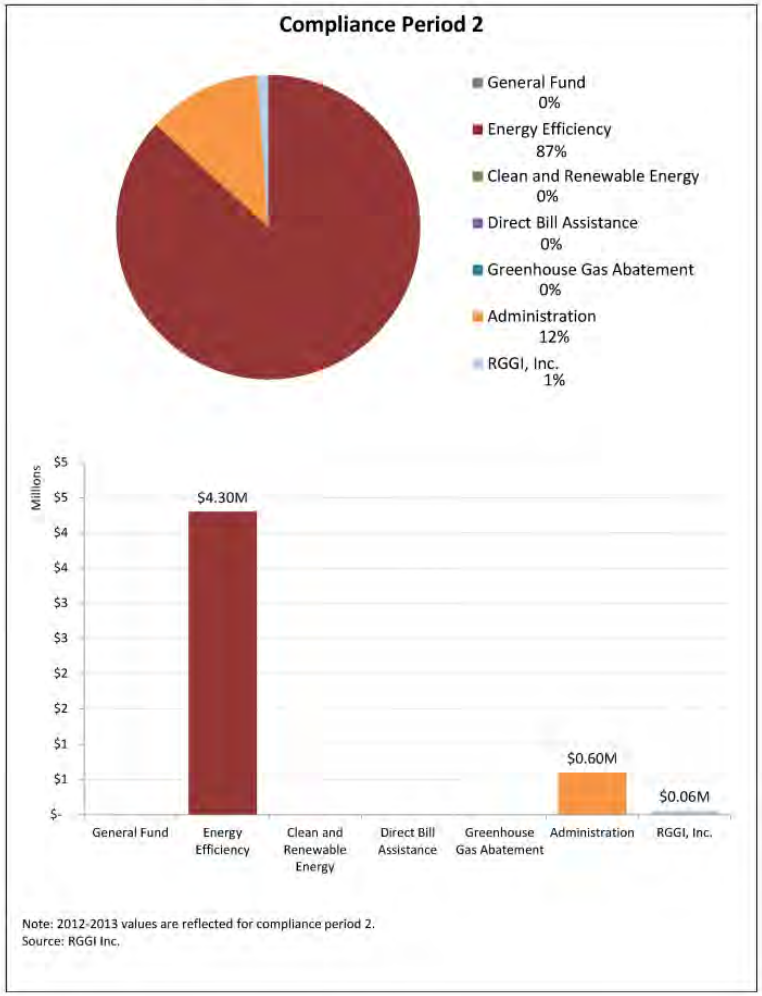




Rhode Island RGGI Proceed Spending

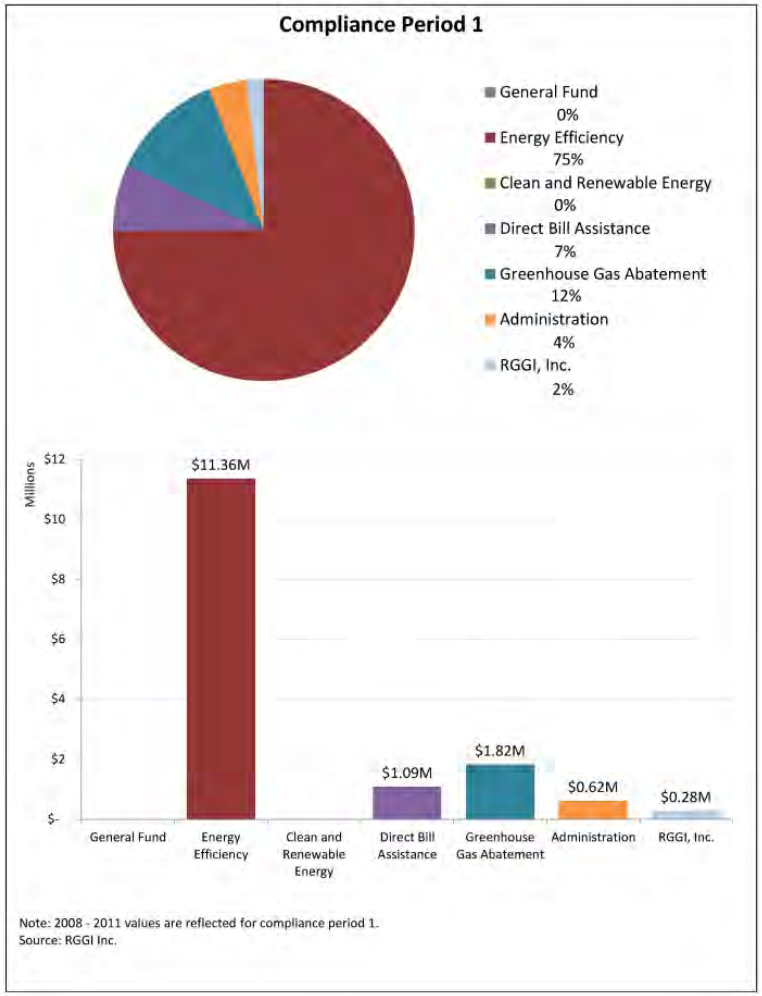


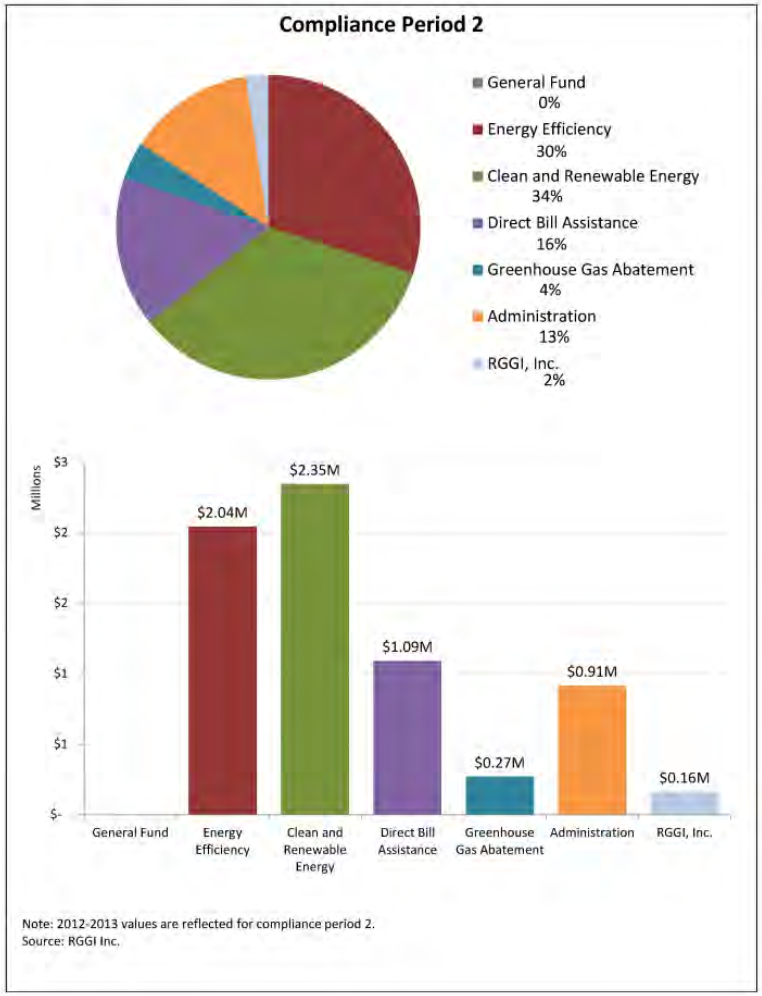
Note: 2008 - 2011 values are reflected for compliance period 1.
Source: RGGI Inc.



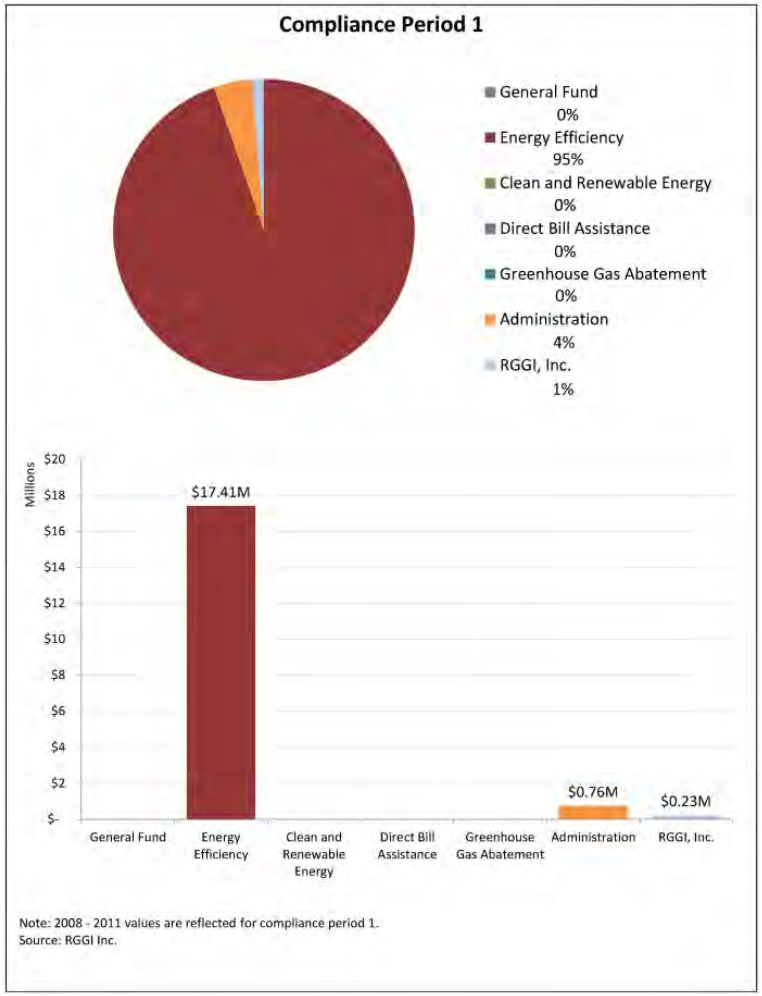
Note: 2012-2013 values are reflected for compliance period 2.
Source: RGGI Inc.

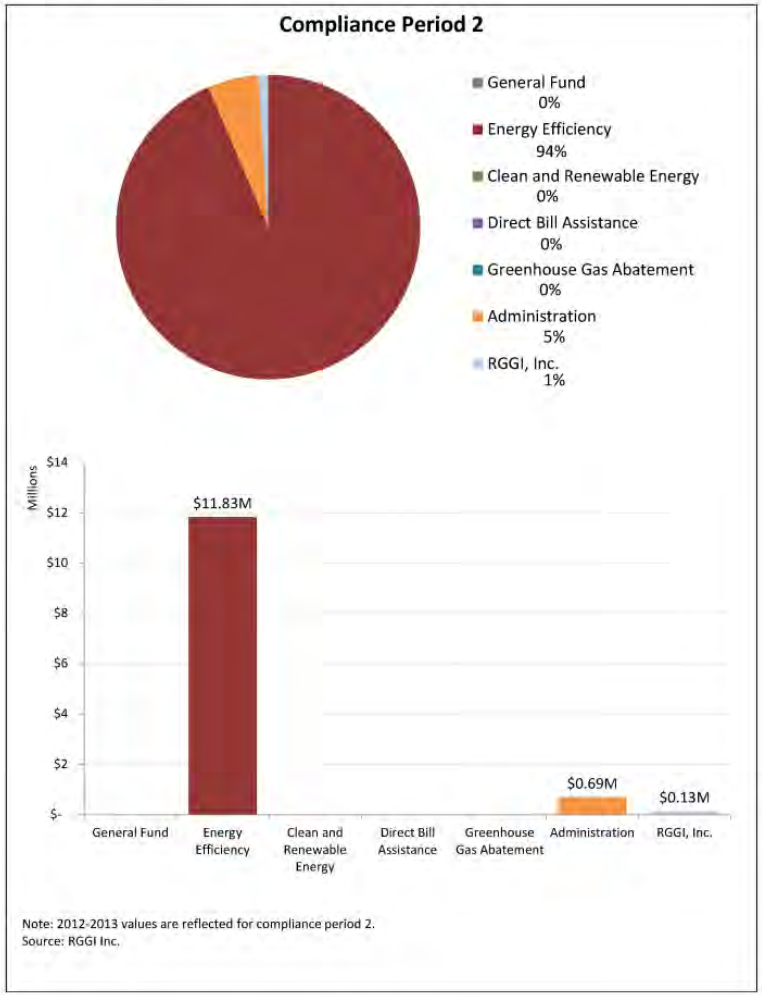
Delaware RGGI Proceed Spending



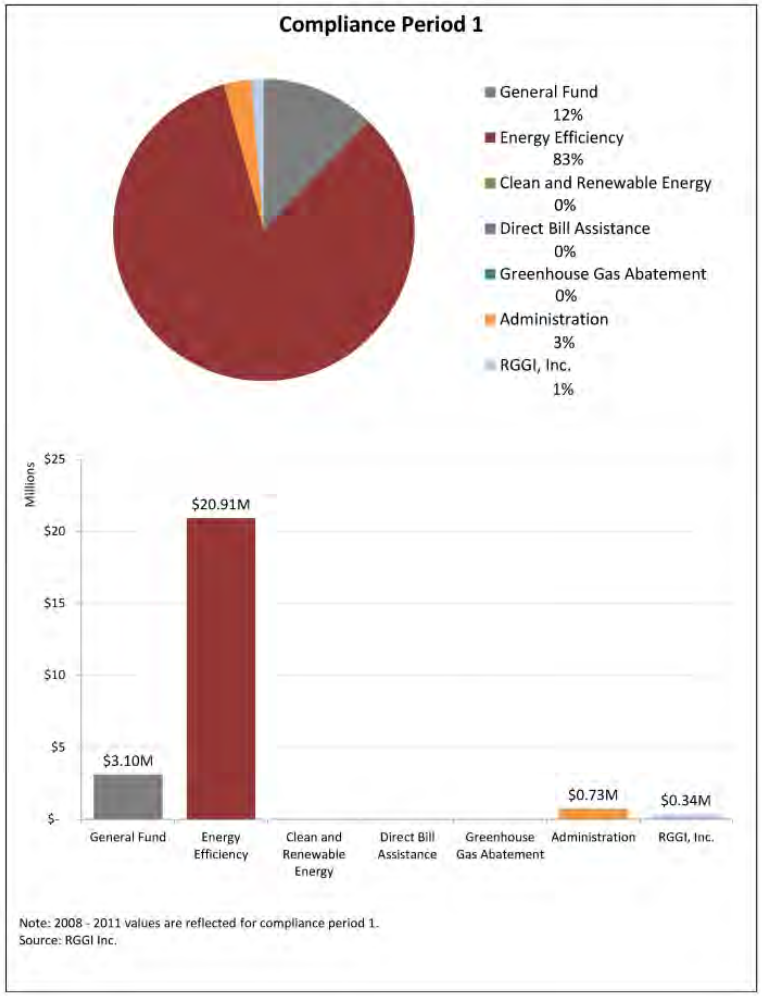


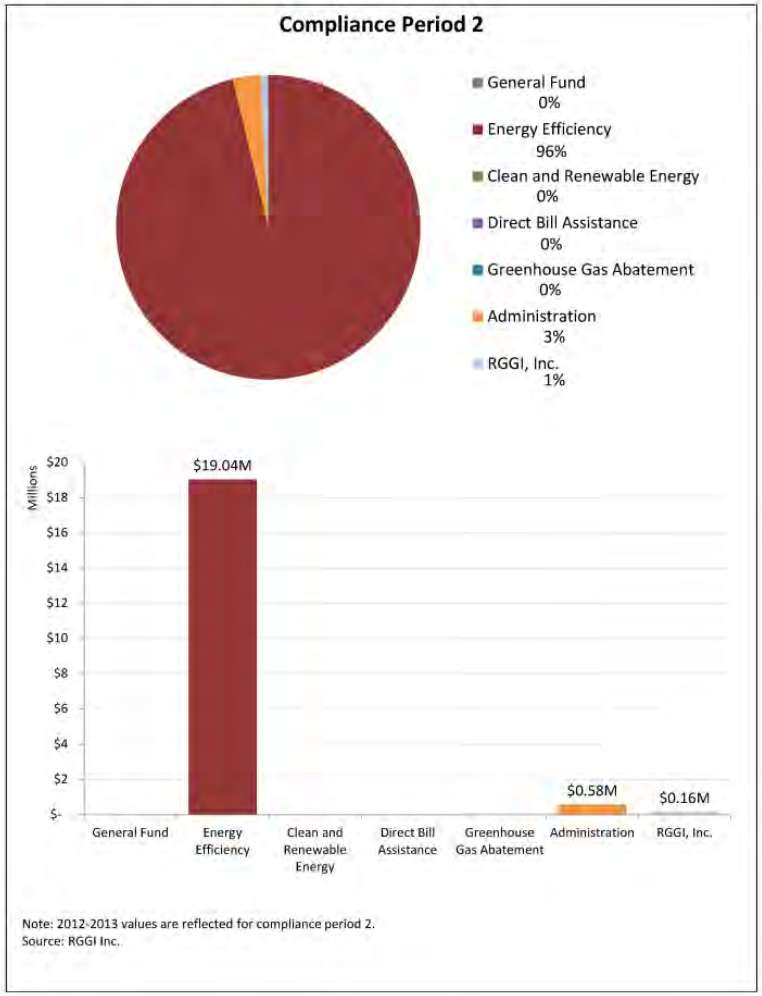
Maine RGGI Proceed Spending



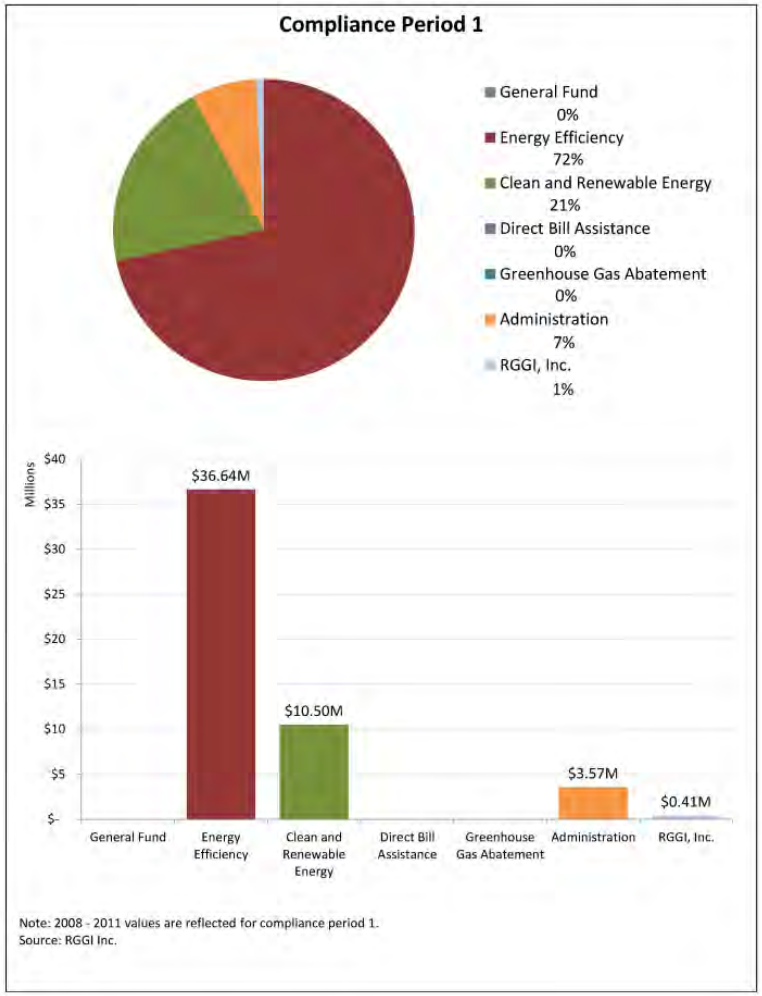


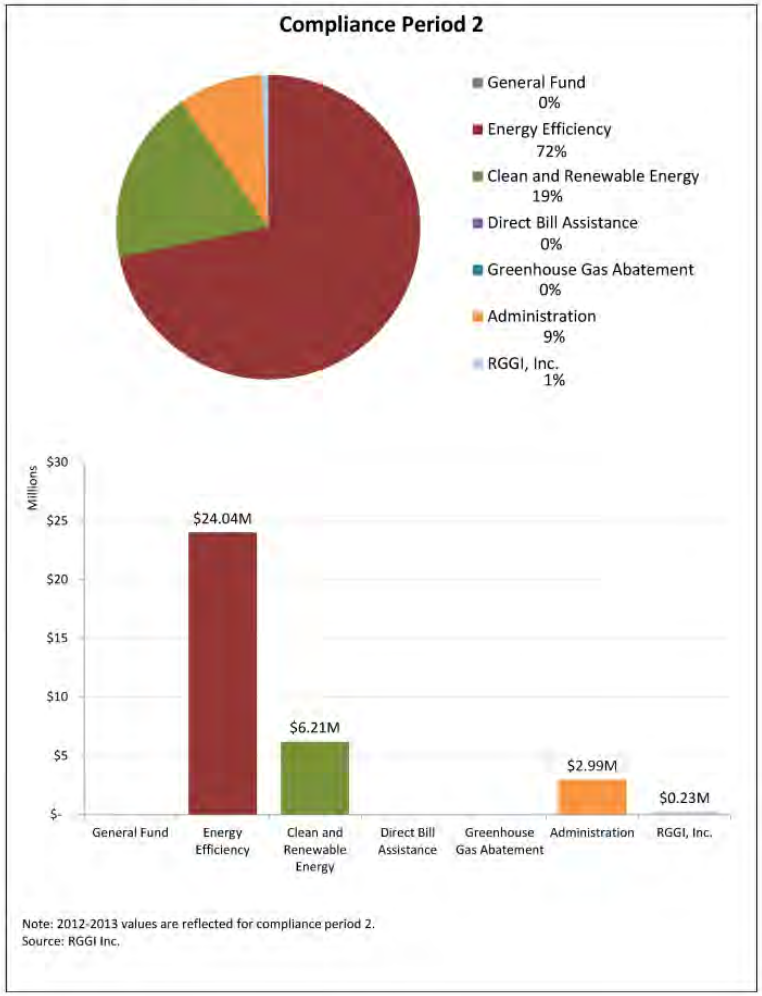
New Hampshire RGGI Proceed Spending



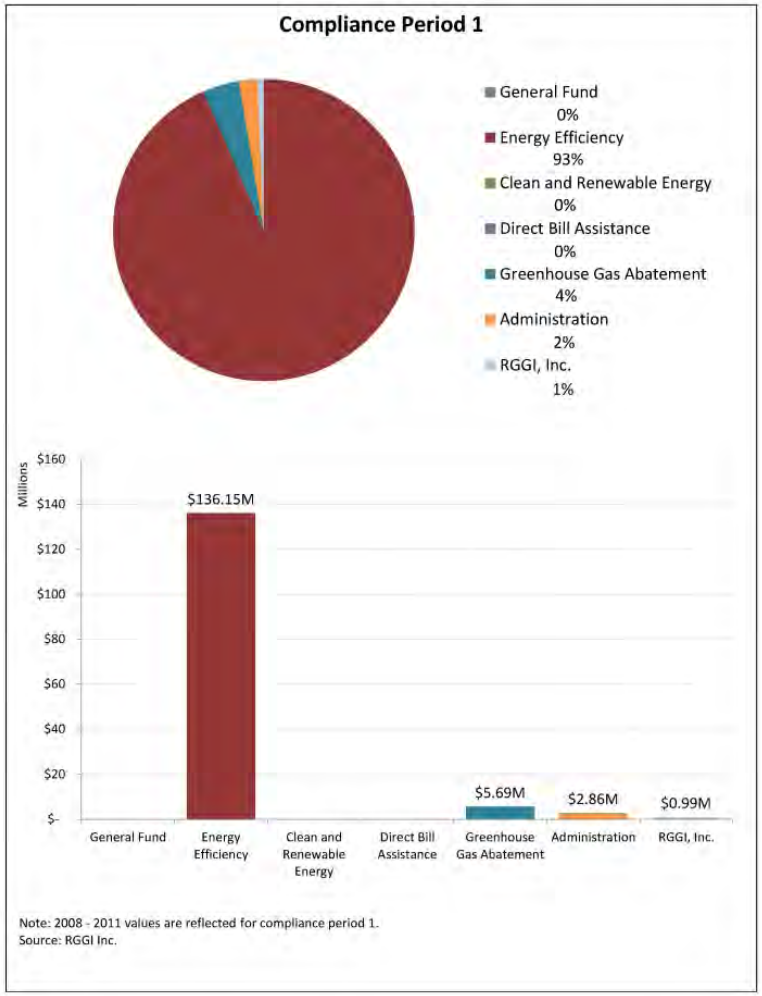


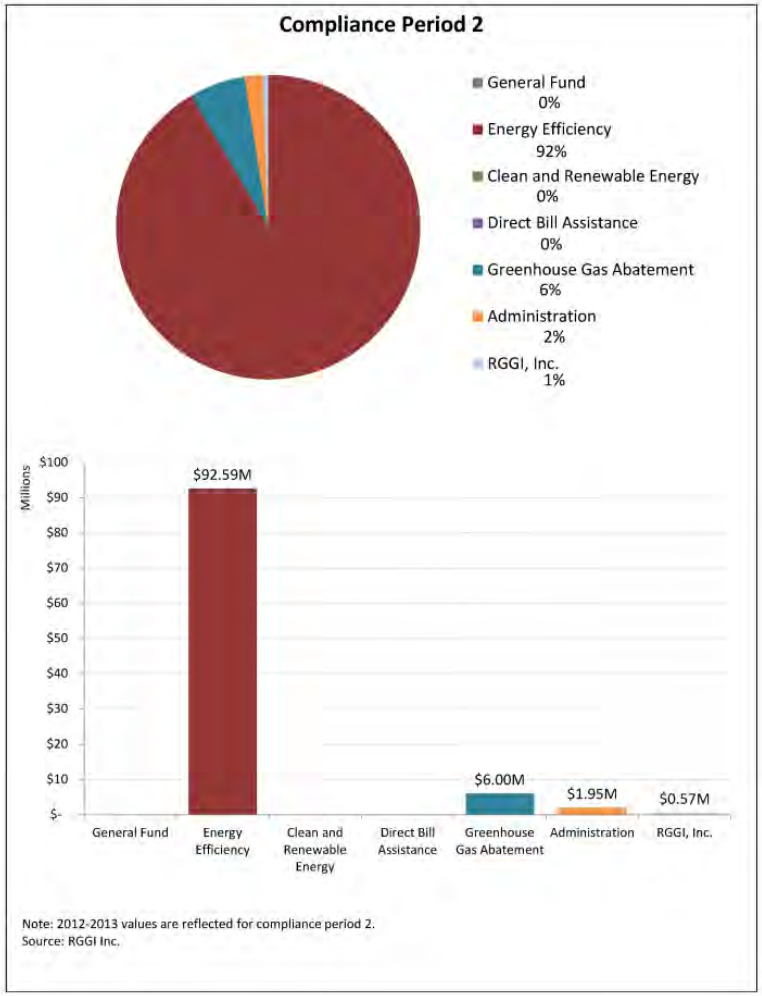
Connecticut RGGI Proceed Spending



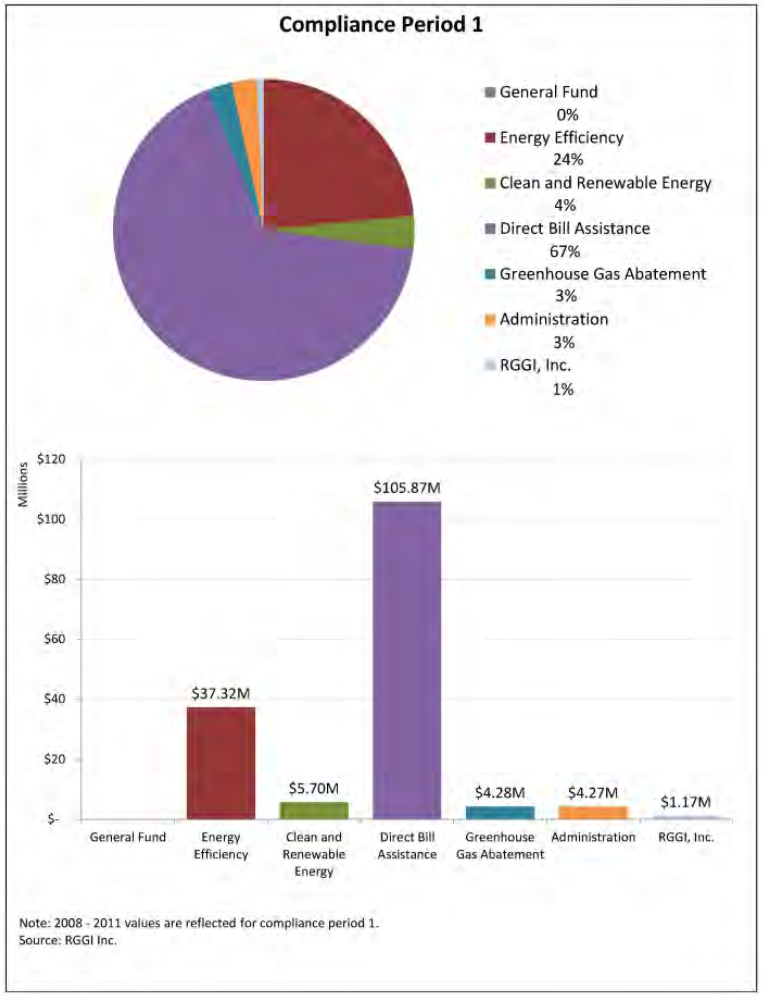


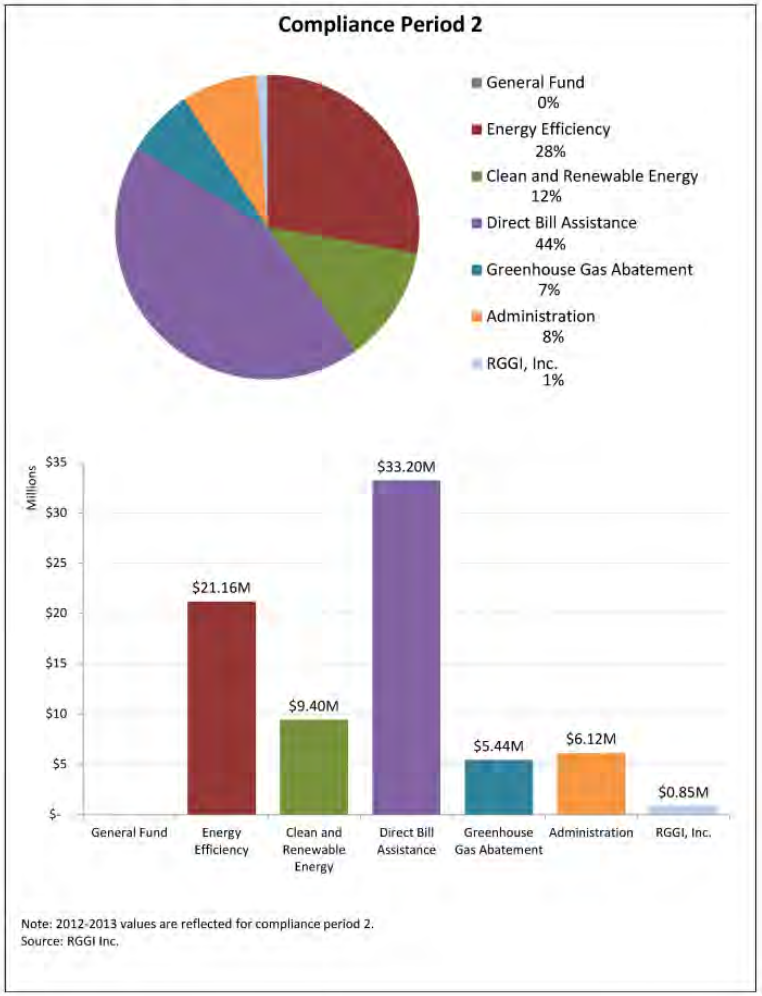
Massachusetts RGGI Proceed Spending



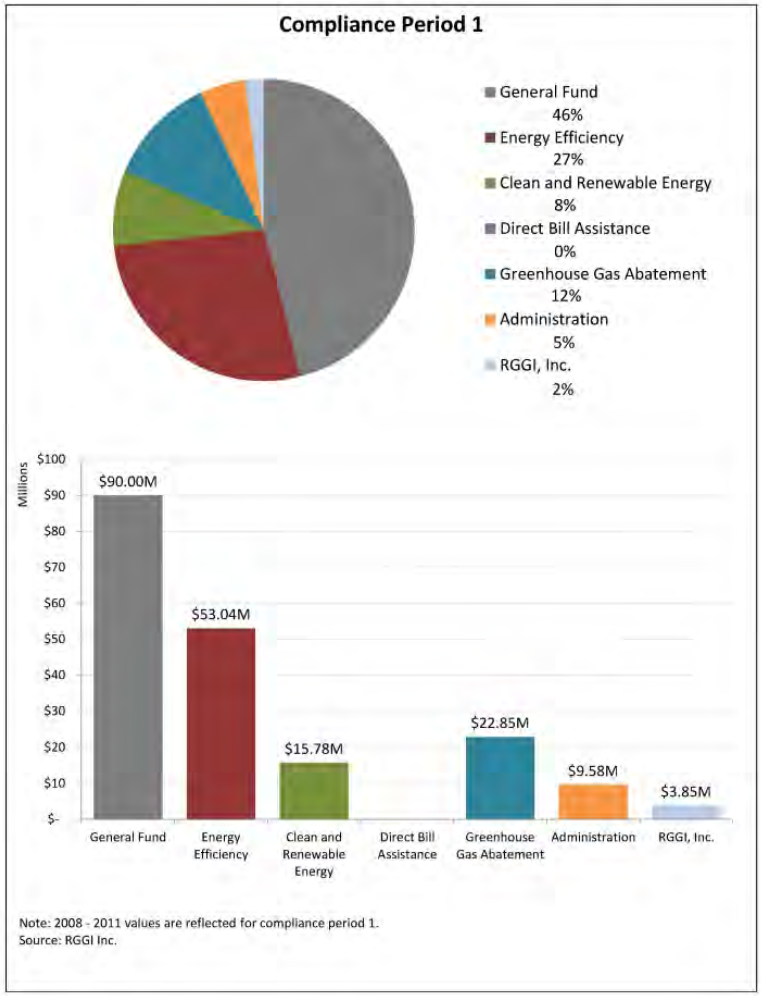


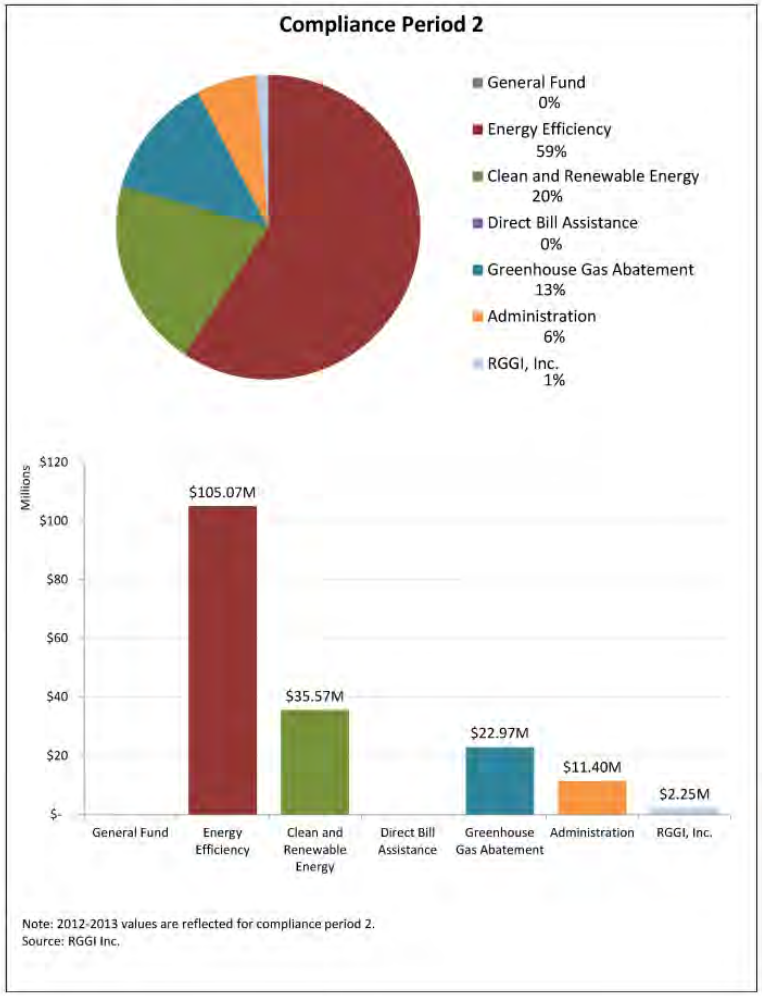
Maryland RGGI Proceed Spending





New York RGGI Proceed Spending





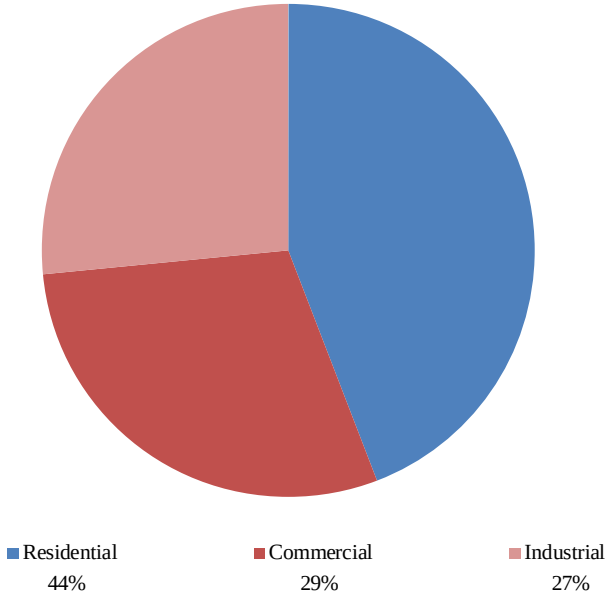
APPENDIX 3

State Electricity Revenues and Energy Efficiency Spending

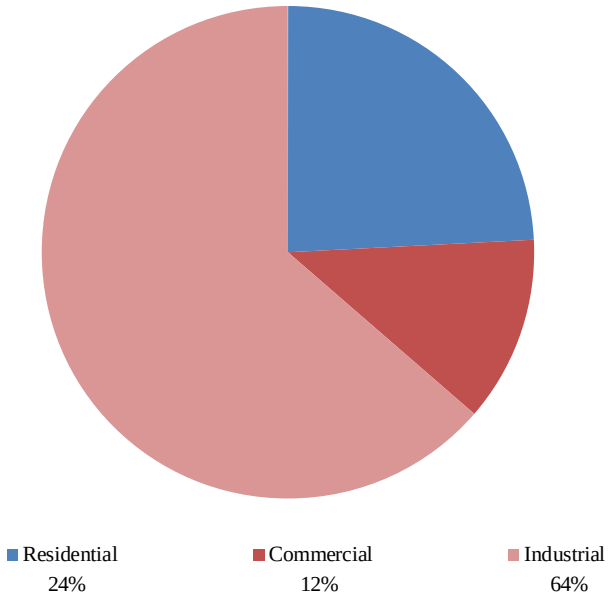
Alabama

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Alabama Electric Revenues by Customer Class



Alabama Energy Efficiency Spending by Customer Class



Notes & Sources:

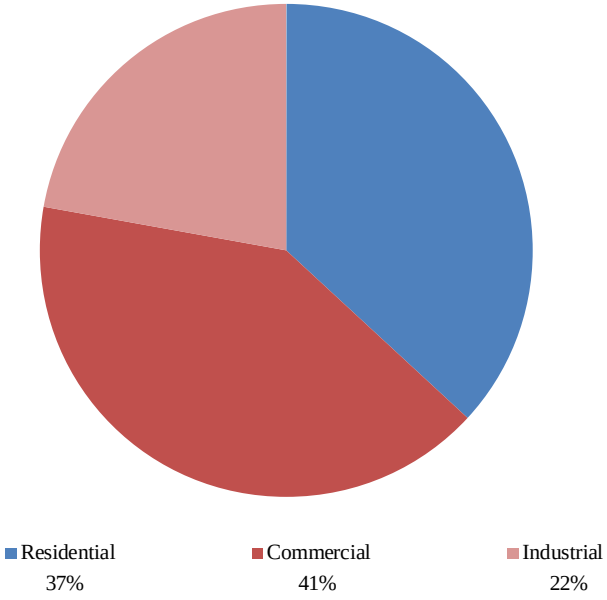
[1] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed May 10, 2014.

[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

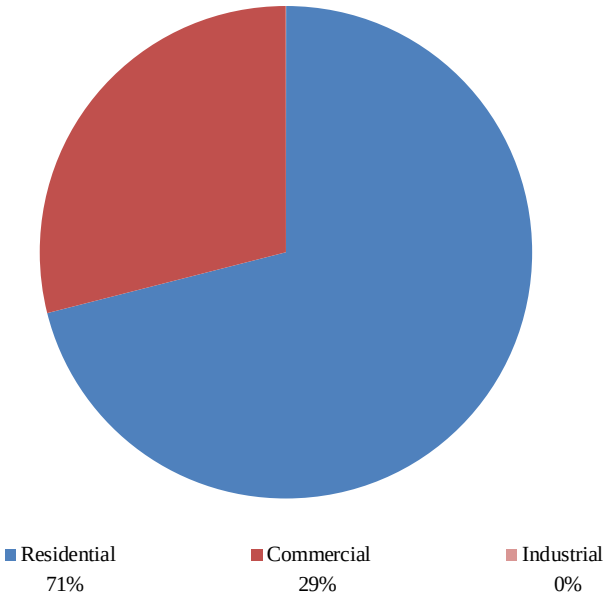
Alaska

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Alaska Electric Revenues by Customer Class



Alaska Energy Efficiency Spending by Customer Class



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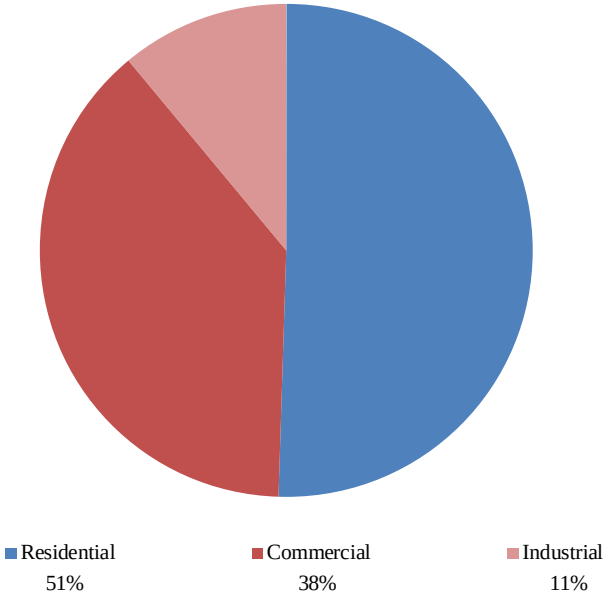
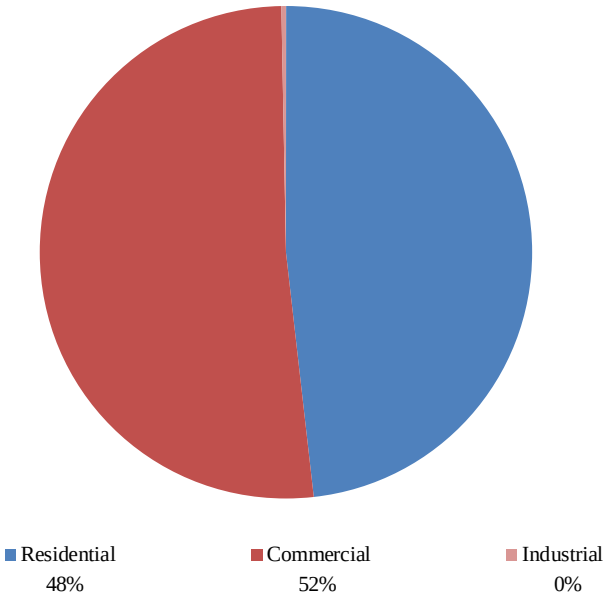
Arizona

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Arizona Electric Revenues by Customer Class



Arizona Energy Efficiency Spending by Customer Class



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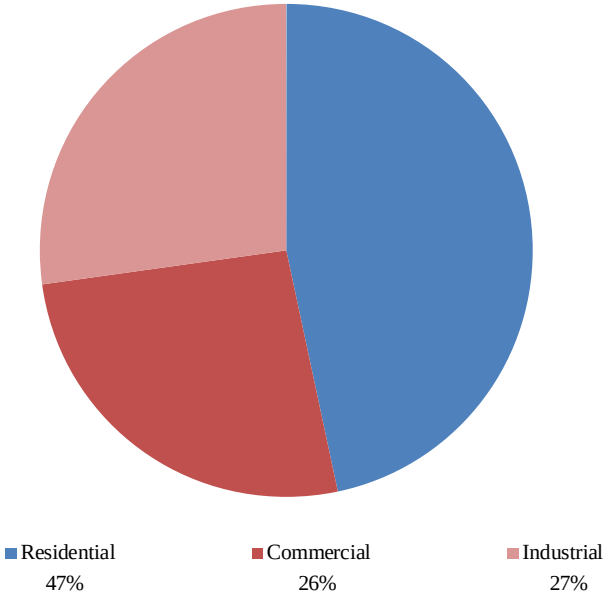
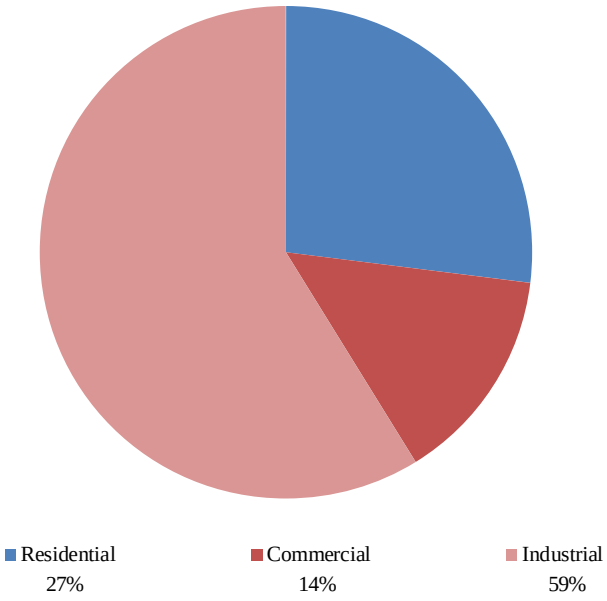
Arkansas

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Arkansas Electric Revenues by Customer Class



Arkansas Energy Efficiency Spending by Customer Class



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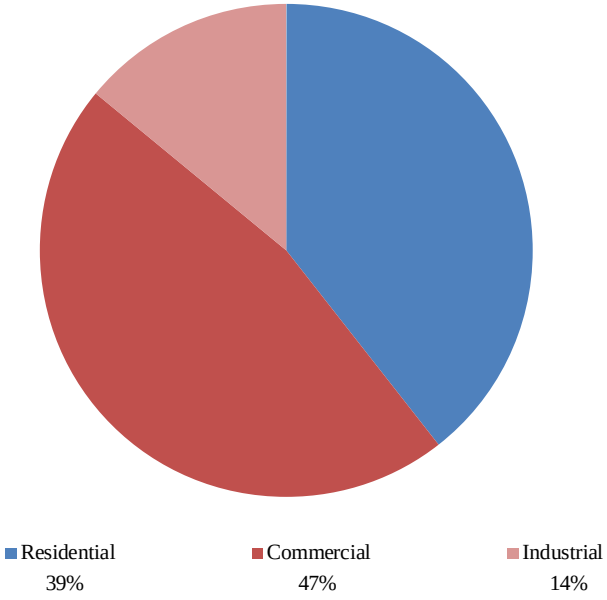
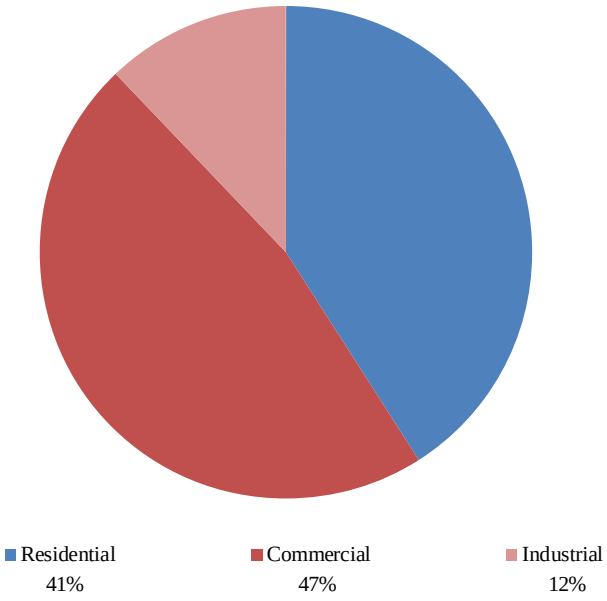
California

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

California Electric Revenues by Customer Class



California Energy Efficiency Spending by Customer Class



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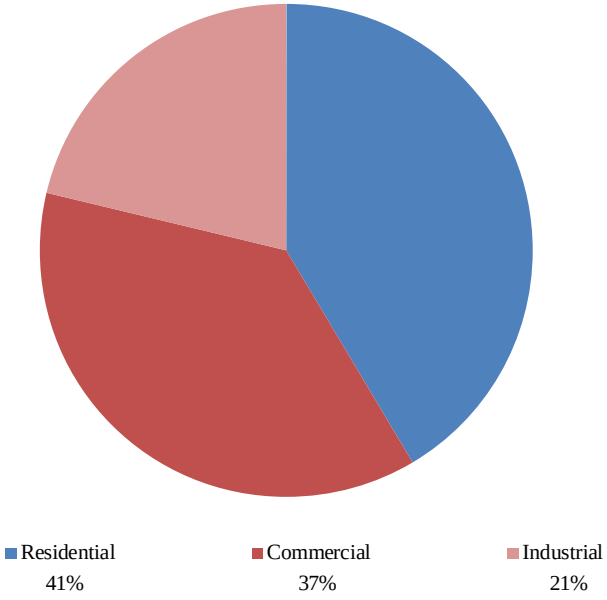
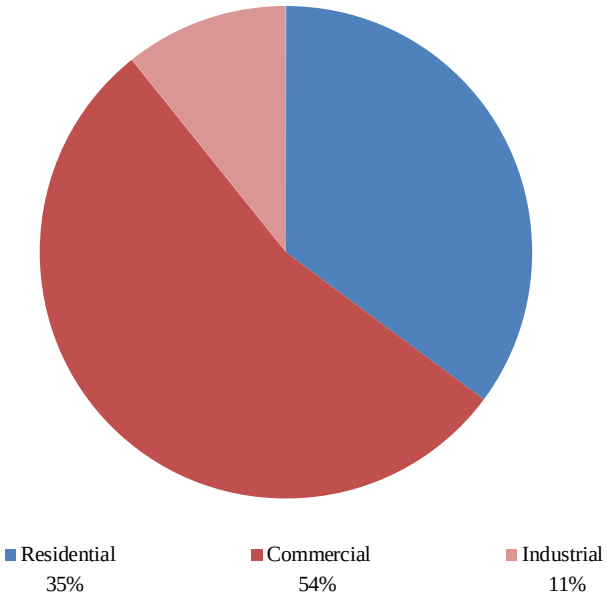
Colorado

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Colorado Electric Revenues by Customer Class



Colorado Energy Efficiency Spending by Customer Class



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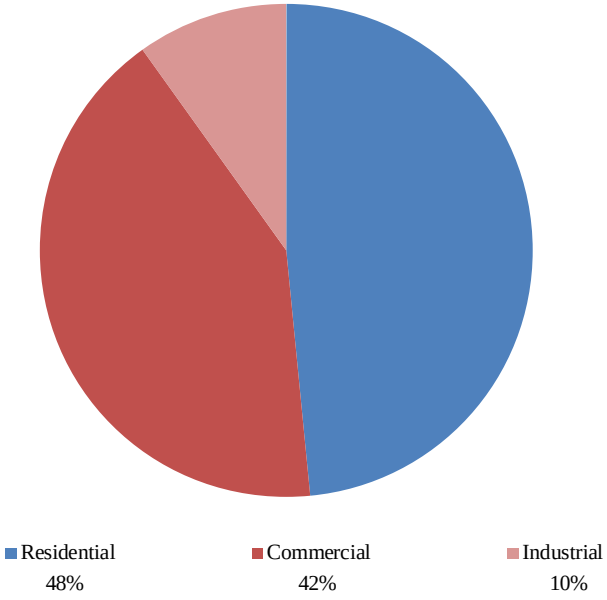
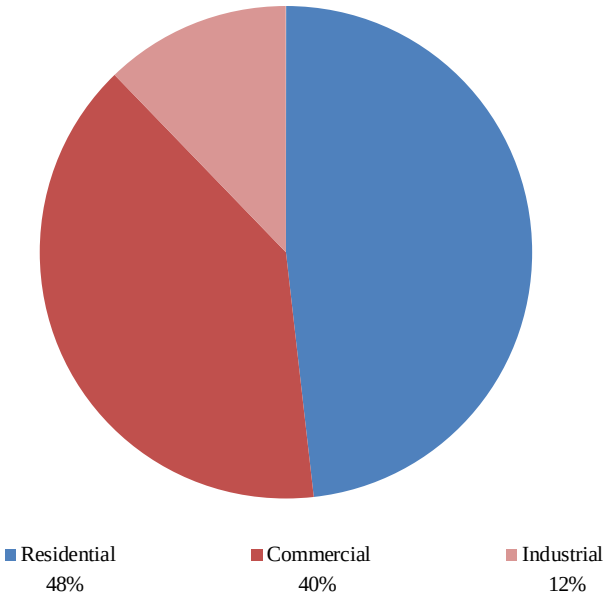
Connecticut

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Connecticut Electric Revenues by Customer Class



Connecticut Energy Efficiency Spending by Customer Class



Notes & Sources:

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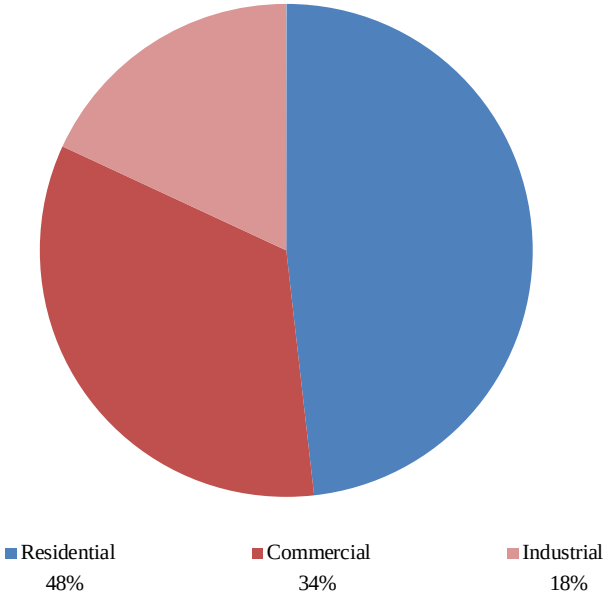
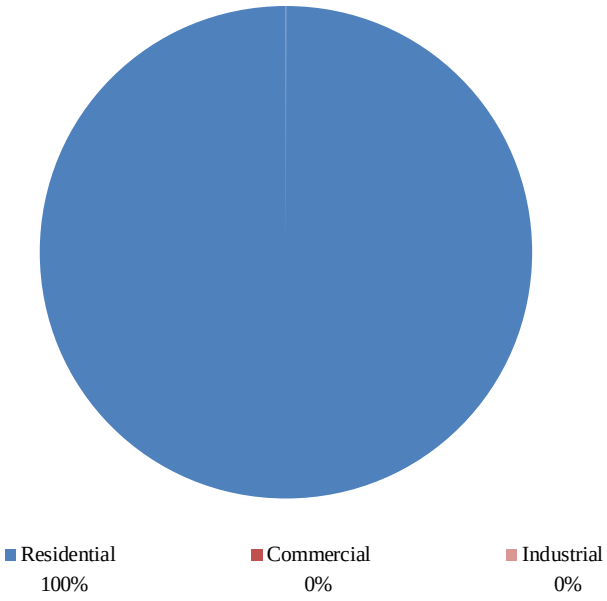
Delaware

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Delaware Electric Revenues by Customer Class



Delaware Energy Efficiency Spending by Customer Class



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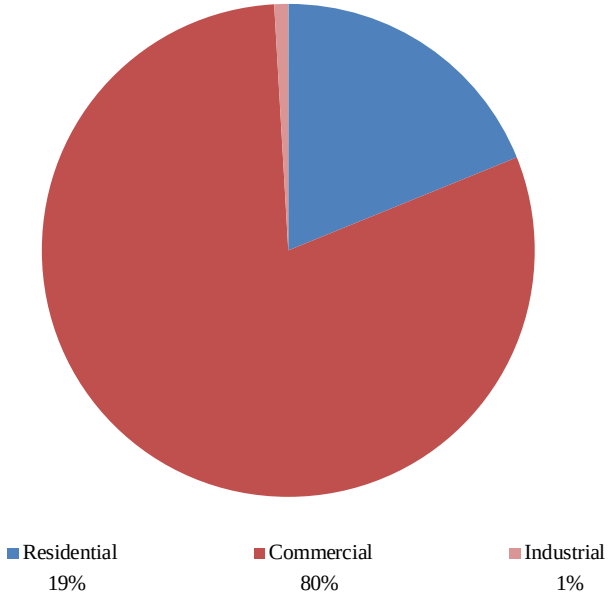
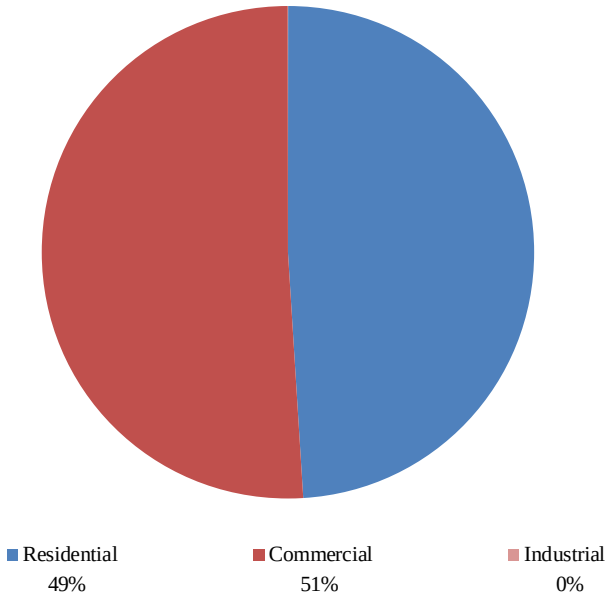
District of Columbia

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

District of Columbia Electric Revenues by Customer Class



District of Columbia Energy Efficiency Spending by Customer Class



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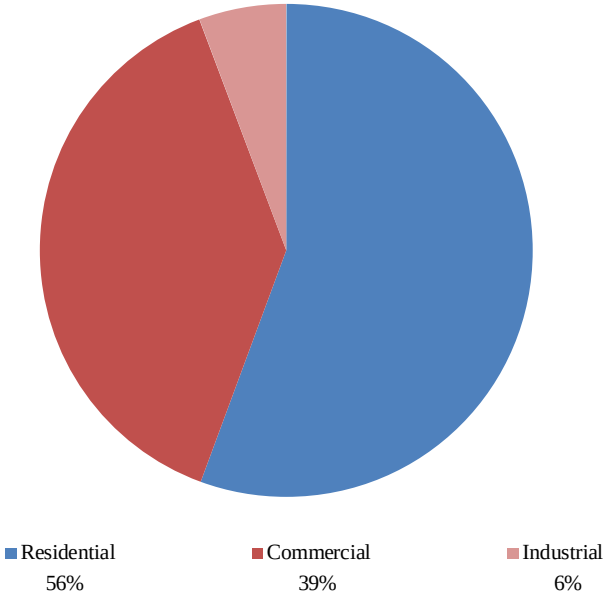
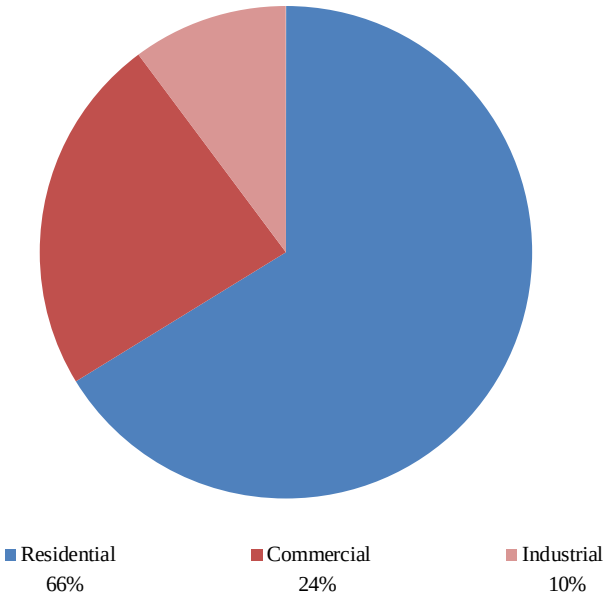
Florida

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Florida Electric Revenues by Customer Class



Florida Energy Efficiency Spending by Customer Class



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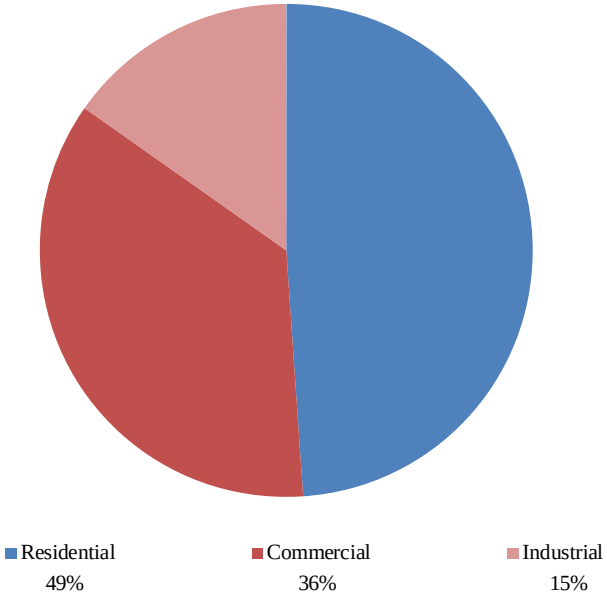
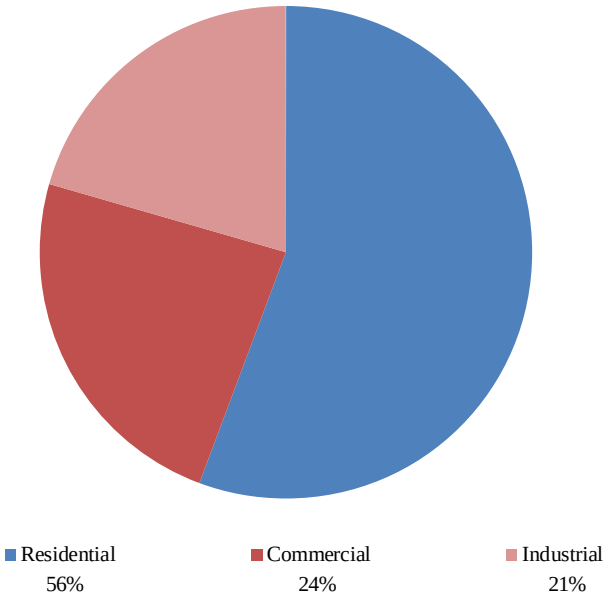
Georgia

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Georgia Electric Revenues by Customer Class



Georgia Energy Efficiency Spending by Customer Class



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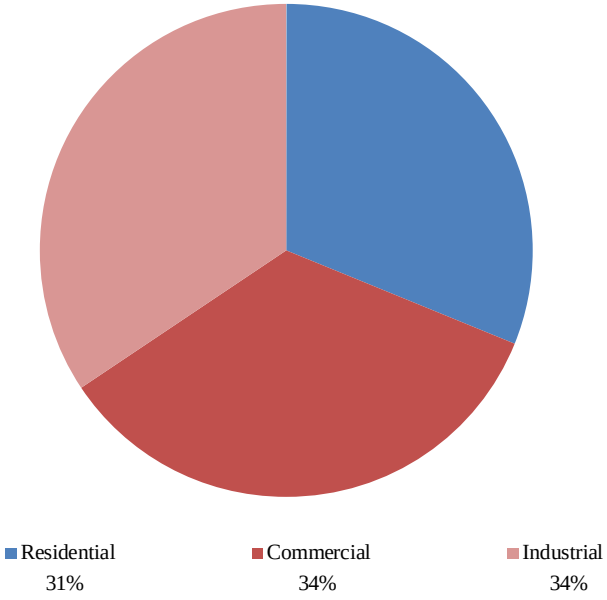
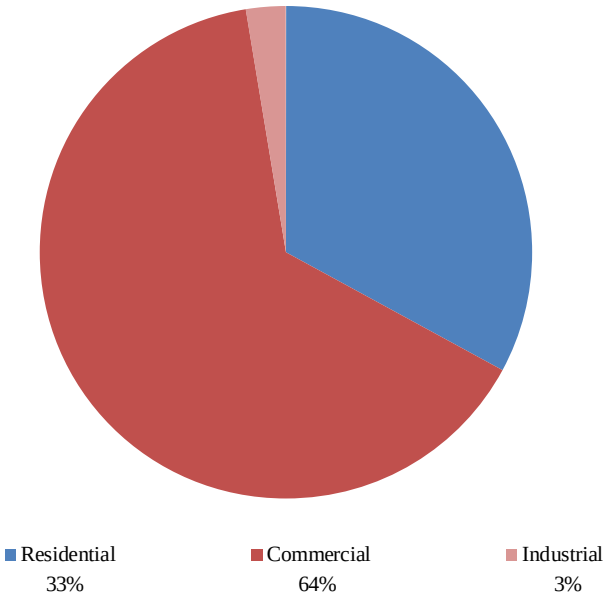
Hawaii

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Hawaii Electric Revenues by Customer Class



Hawaii Energy Efficiency Spending by Customer Class



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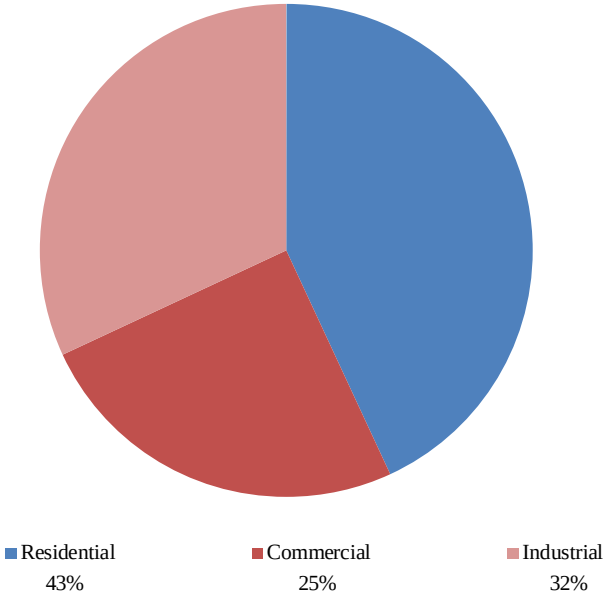
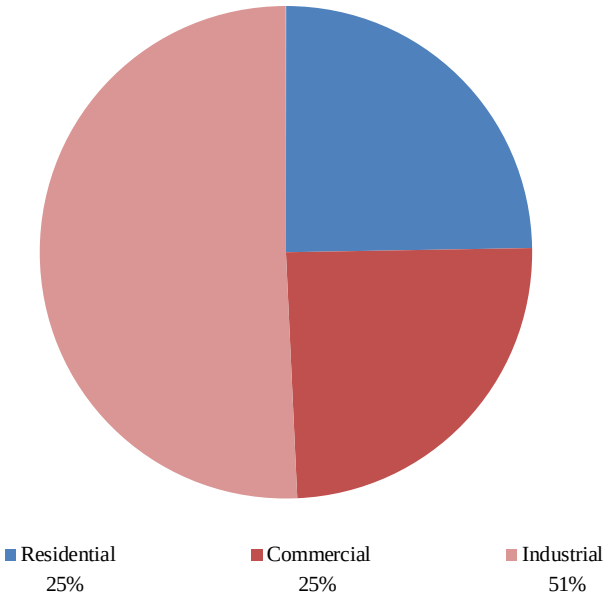
Idaho

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Idaho Electric Revenues by Customer Class



Idaho Energy Efficiency Spending by Customer Class



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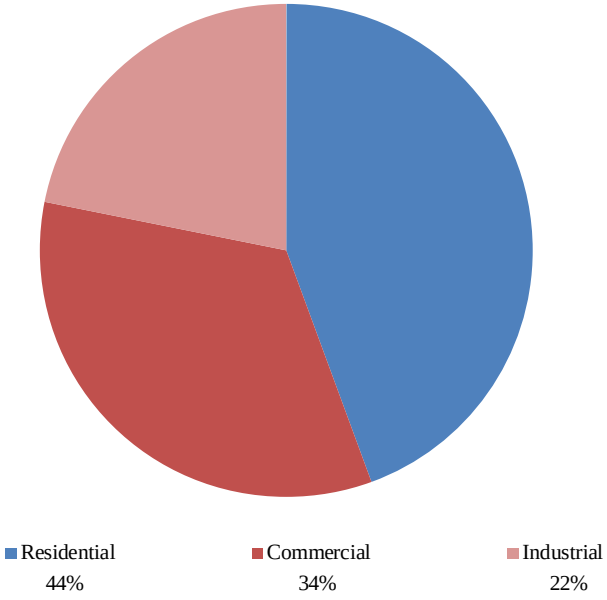
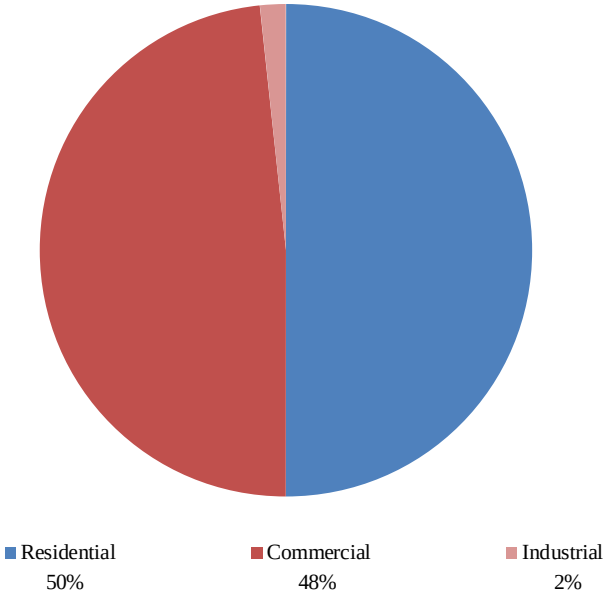
Illinois

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Illinois Electric Revenues by Customer Class



Illinois Energy Efficiency Spending by Customer Class



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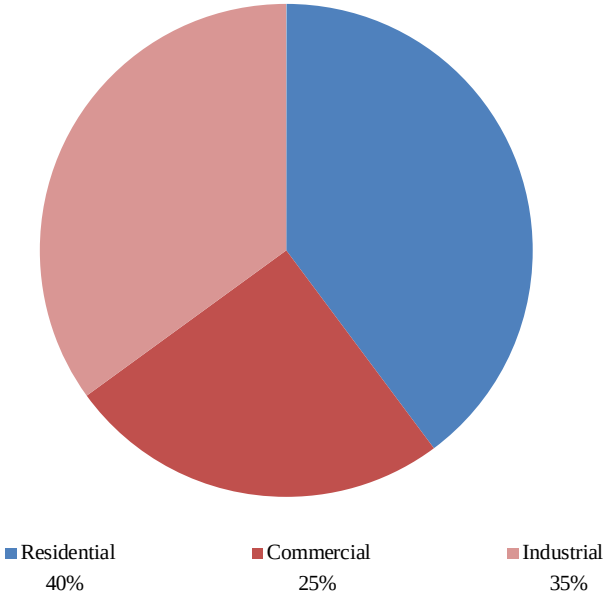
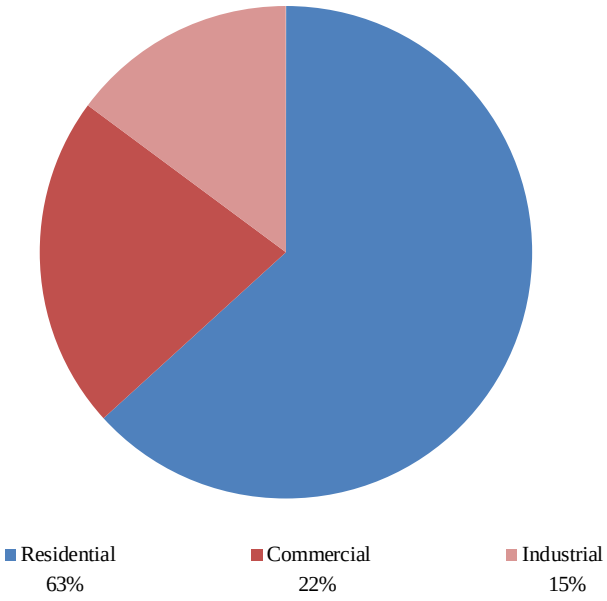
Indiana

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Indiana Electric Revenues by Customer Class



Indiana Energy Efficiency Spending by Customer Class



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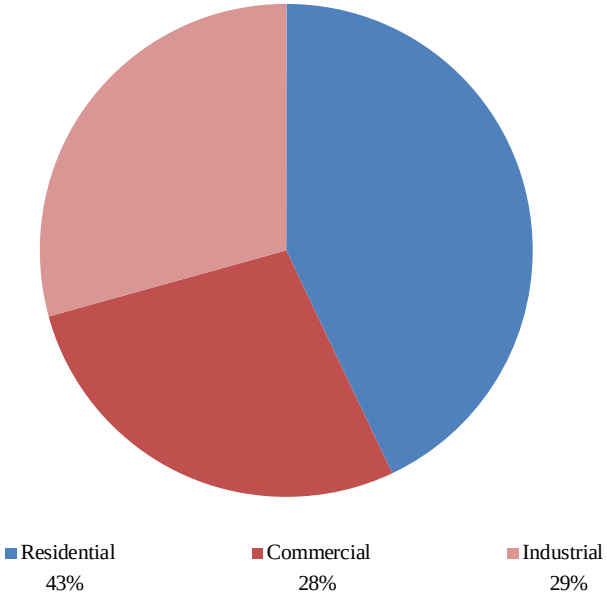
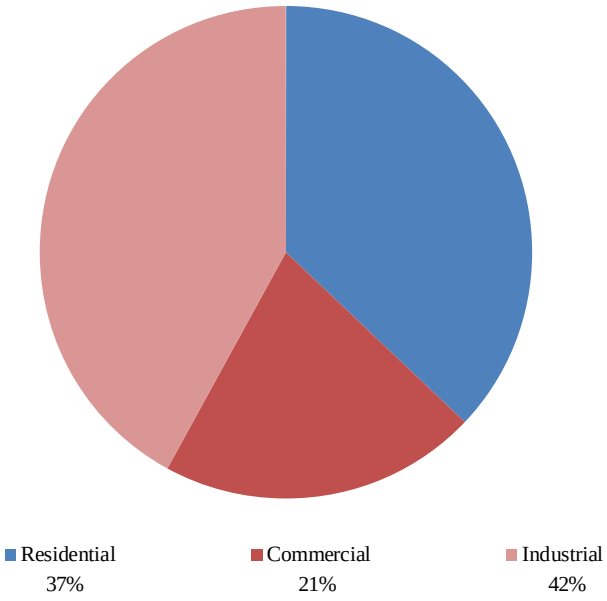
Iowa

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Iowa Electric Revenues by Customer Class



Iowa Energy Efficiency Spending by Customer Class



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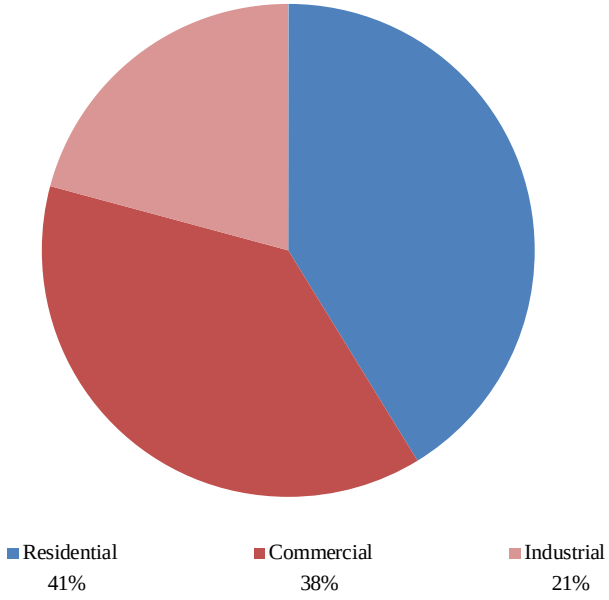
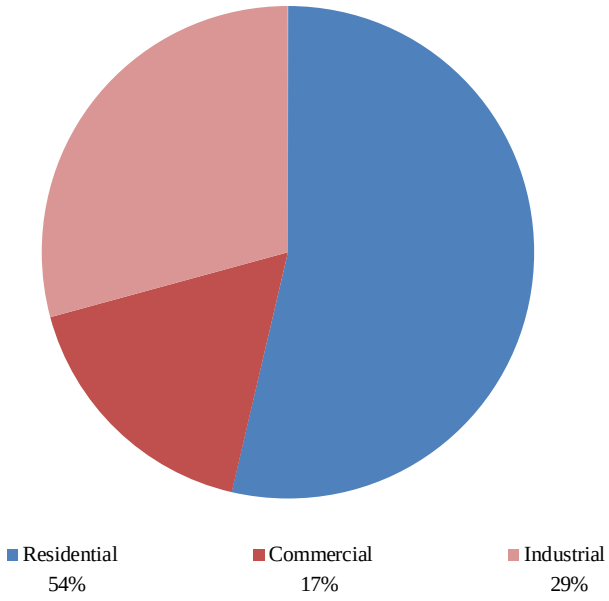
Kansas

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Kansas Electric Revenues by Customer Class



Kansas Energy Efficiency Spending by Customer Class



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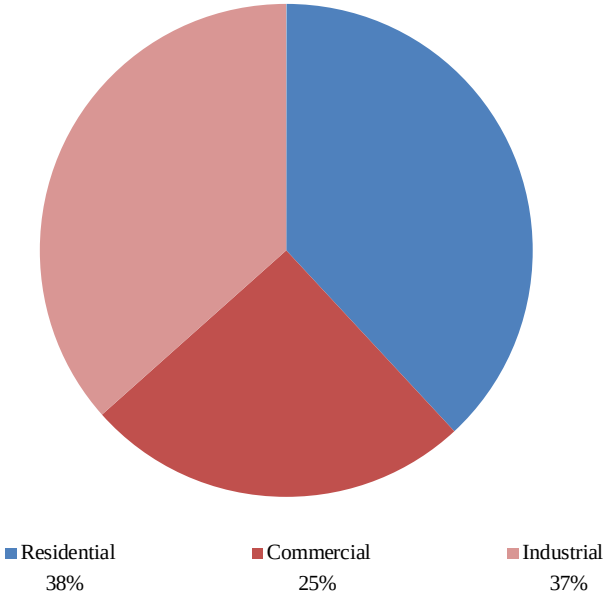
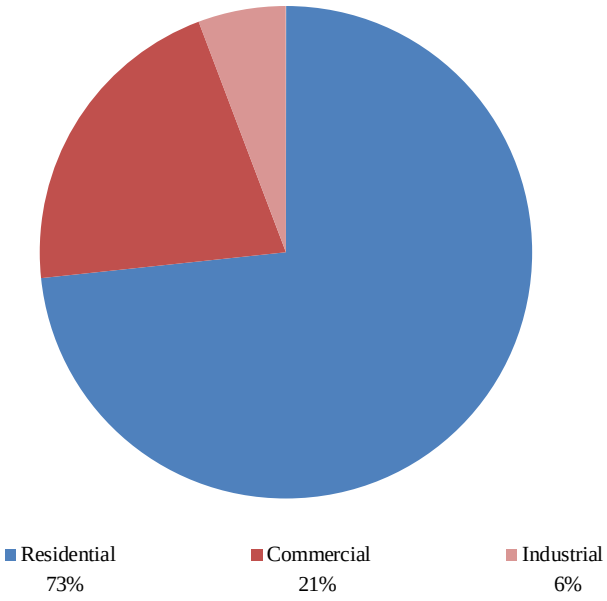
Kentucky

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Kentucky Electric Revenues by Customer Class



Kentucky Energy Efficiency Spending by Customer Class



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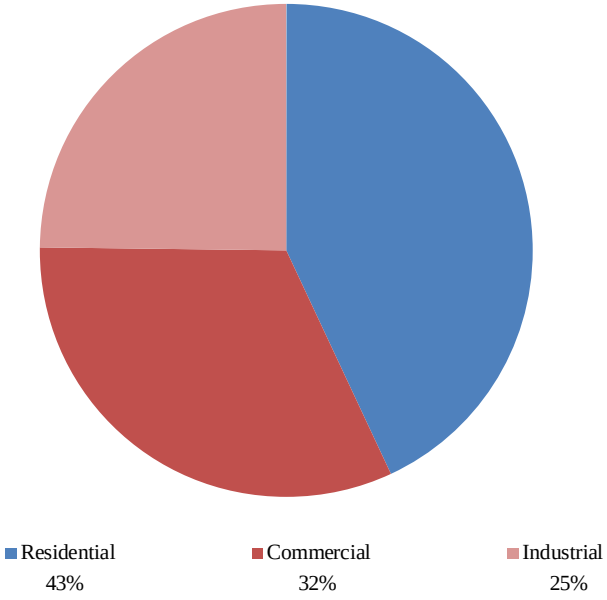
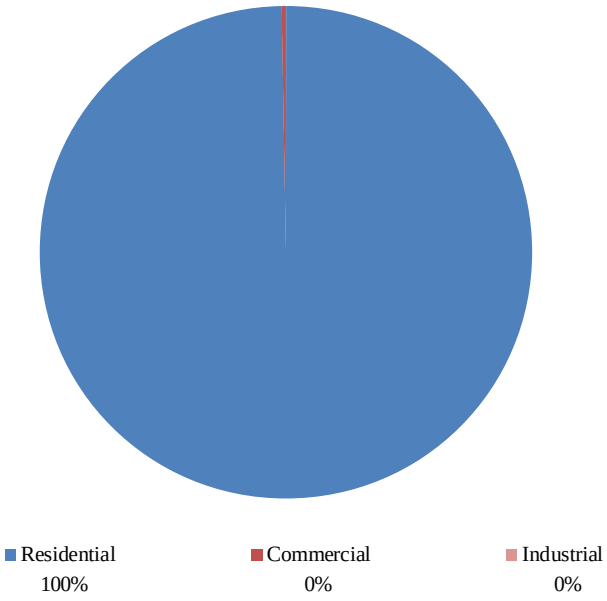
Louisiana

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Louisiana Electric Revenues by Customer Class



Louisiana Energy Efficiency Spending by Customer Class



Notes & Sources:

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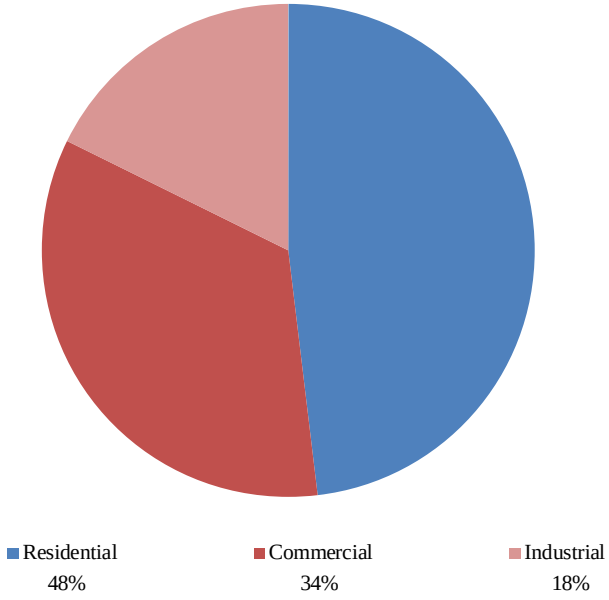
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

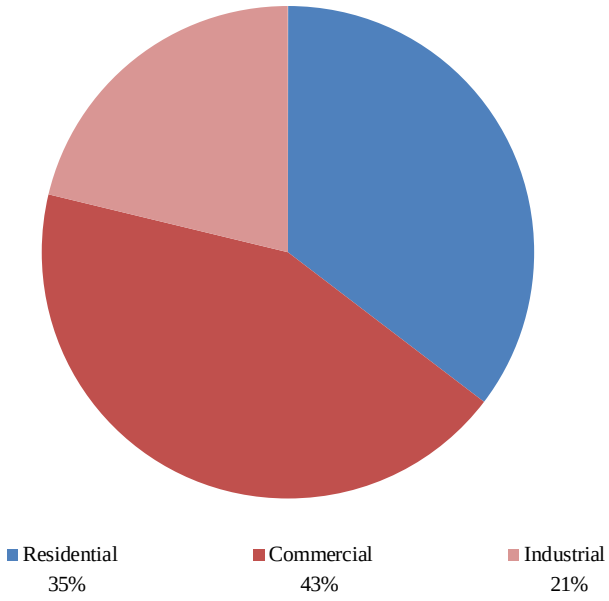
Maine

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Maine Electric Revenues by Customer Class



Maine Energy Efficiency Spending by Customer Class



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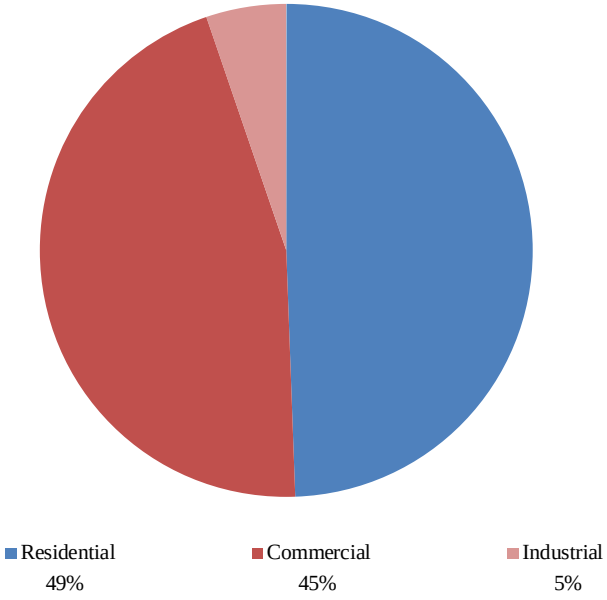
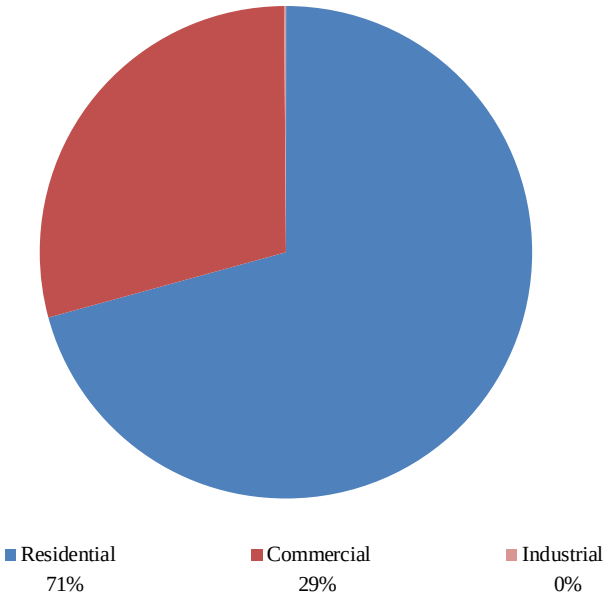
Maryland

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Maryland Electric Revenues by Customer Class



Maryland Energy Efficiency Spending by Customer Class



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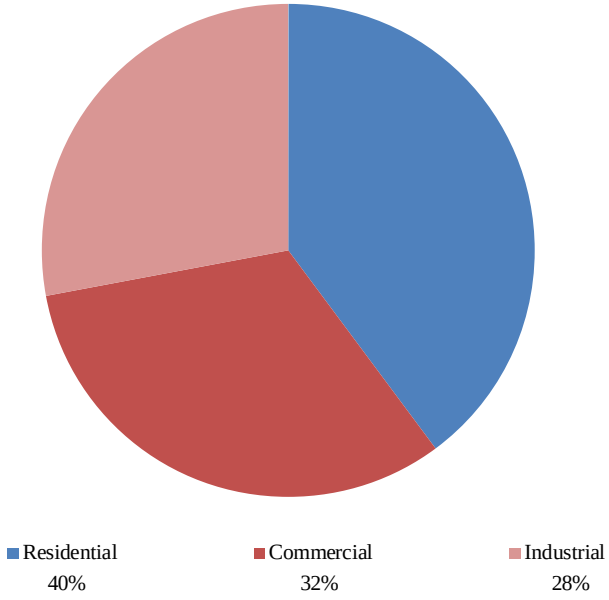
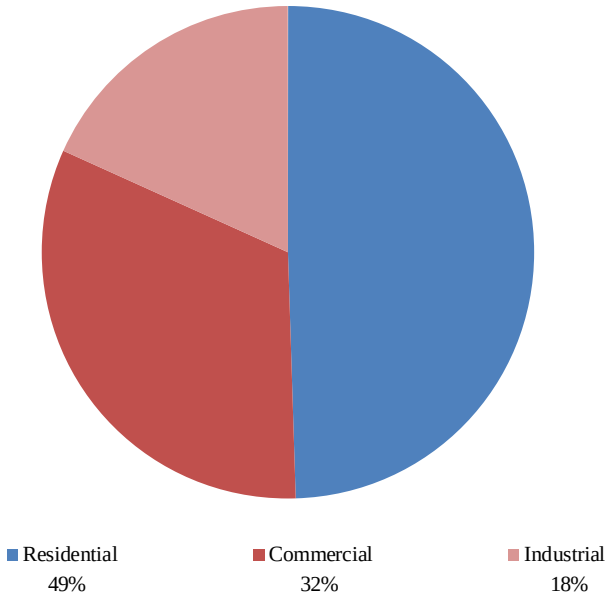
Massachusetts

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Massachusetts Electric Revenues by Customer Class



Massachusetts Energy Efficiency Spending by Customer Class



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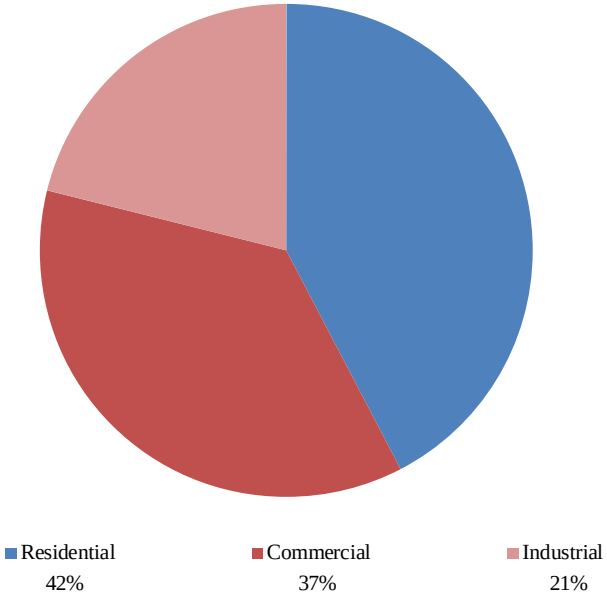
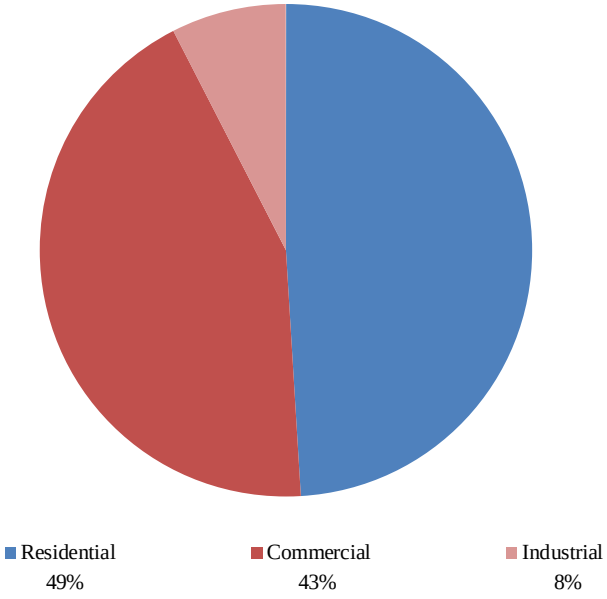
Michigan

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Michigan Electric Revenues by Customer Class



Michigan Energy Efficiency Spending by Customer Class



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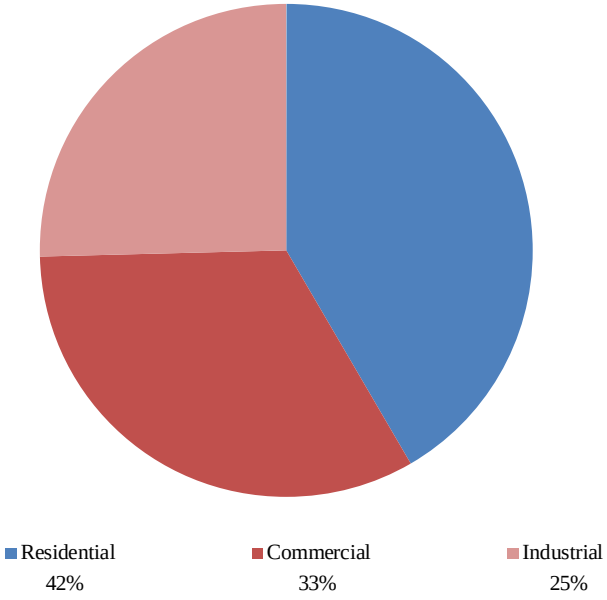
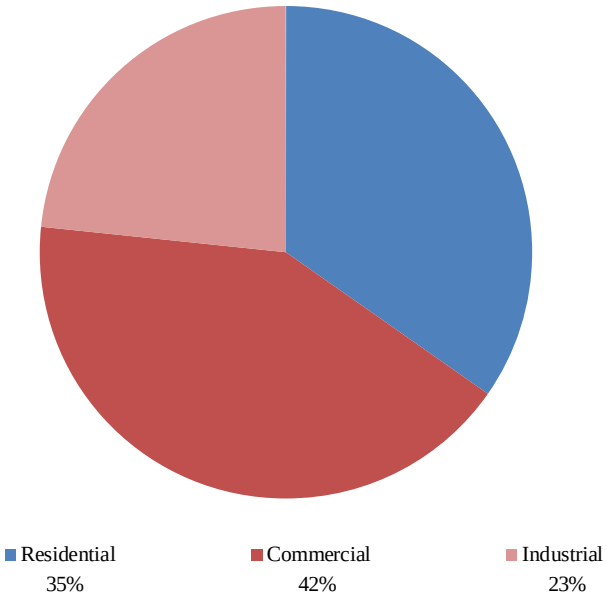
Minnesota

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Minnesota Electric Revenues by Customer Class



Minnesota Energy Efficiency Spending by Customer Class



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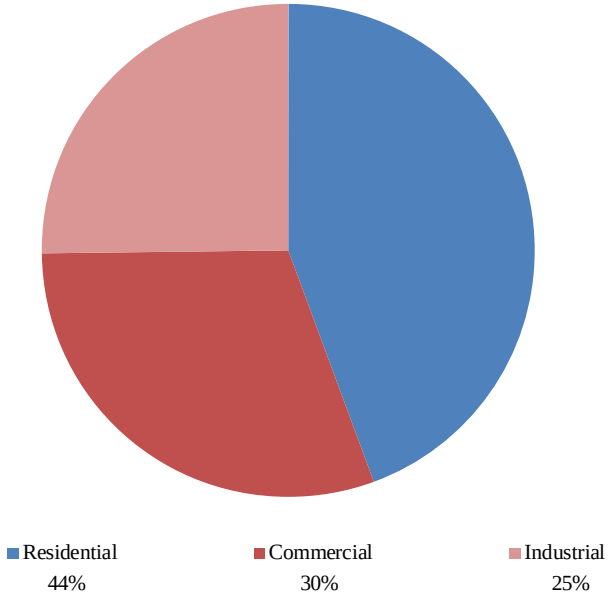
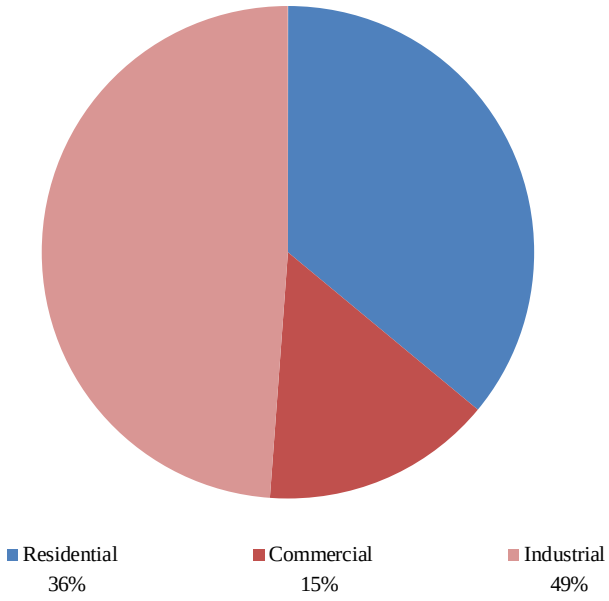
Mississippi

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Mississippi Electric Revenues by Customer Class



Mississippi Energy Efficiency Spending by Customer Class



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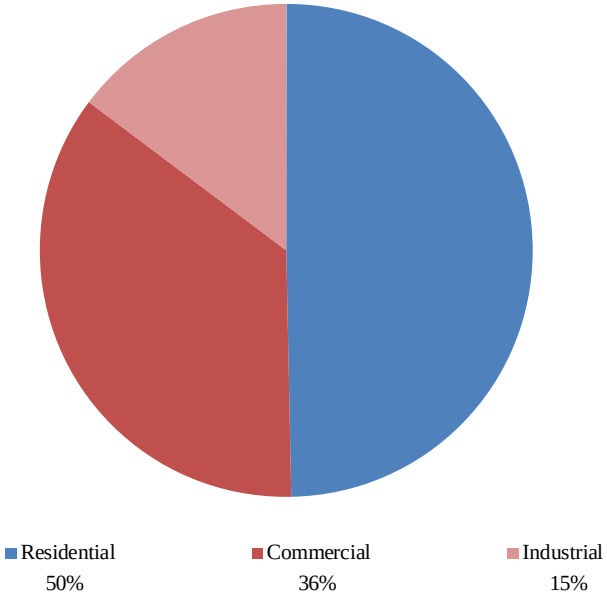
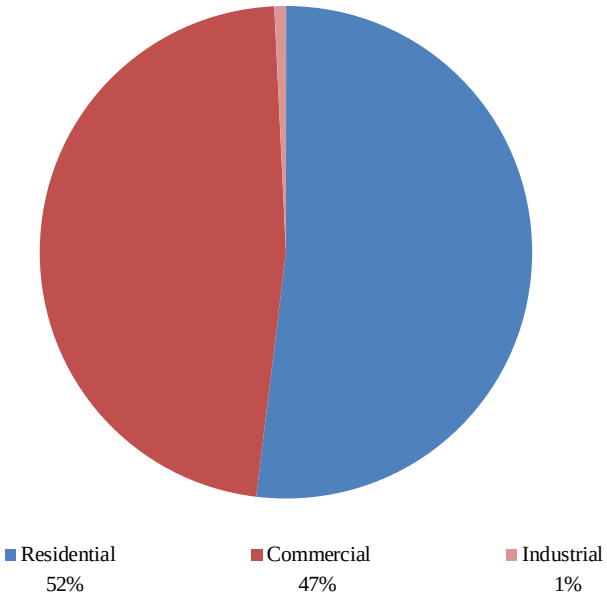
Missouri

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Missouri Electric Revenues by Customer Class



Missouri Energy Efficiency Spending by Customer Class



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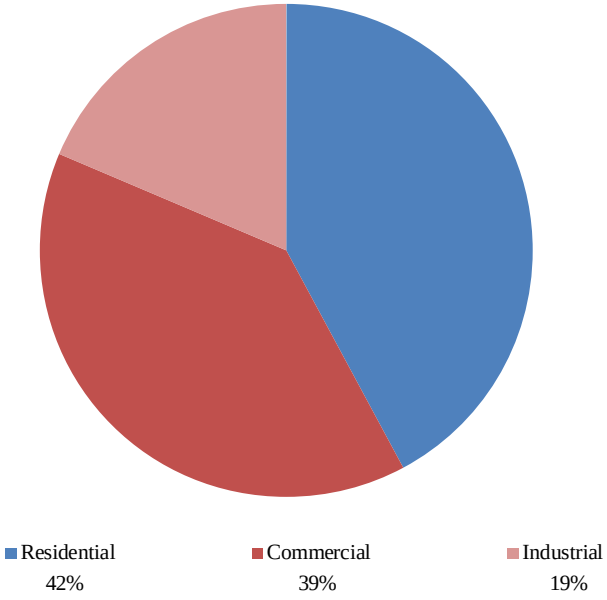
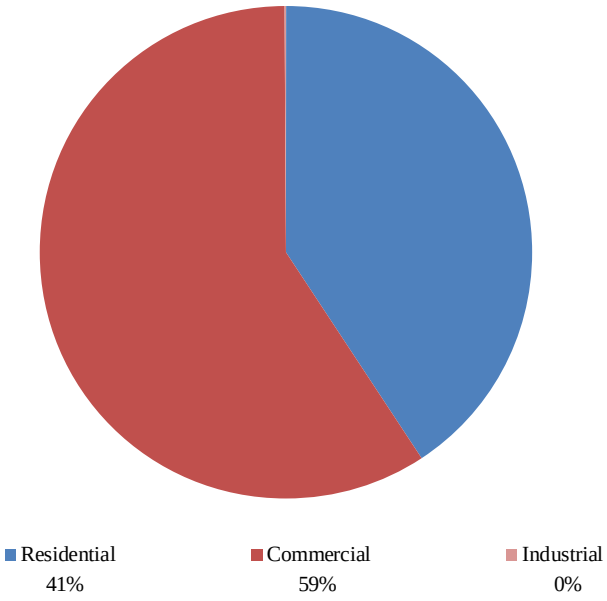
Montana

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Montana Electric Revenues by Customer Class



Montana Energy Efficiency Spending by Customer Class



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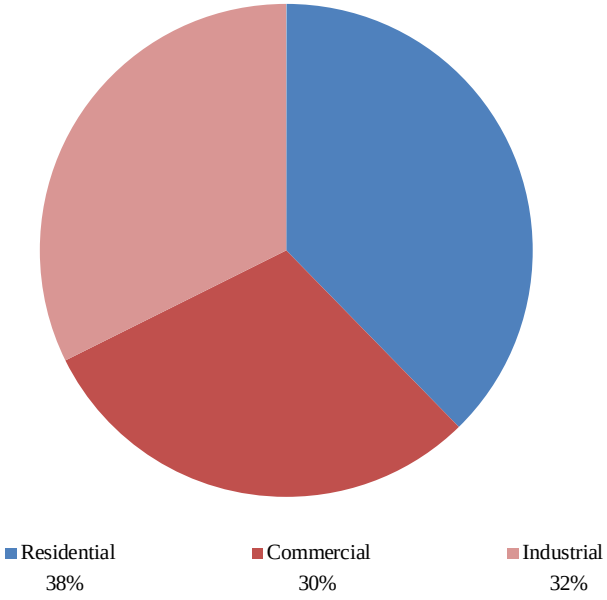
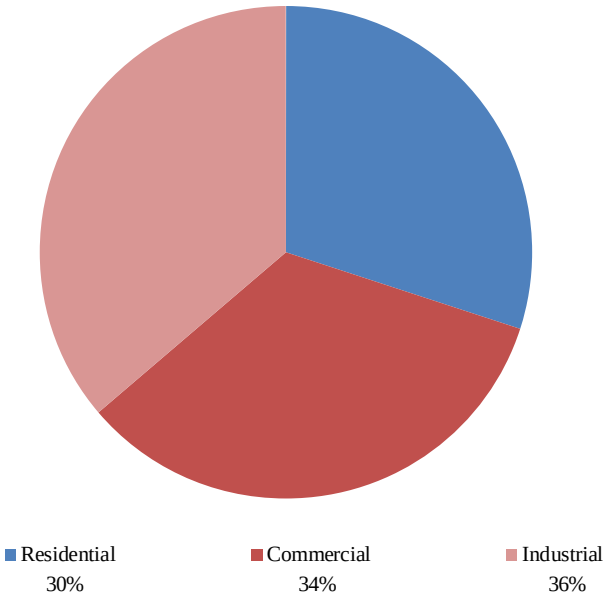
Nebraska

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Nebraska Electric Revenues by Customer Class



Nebraska Energy Efficiency Spending by Customer Class



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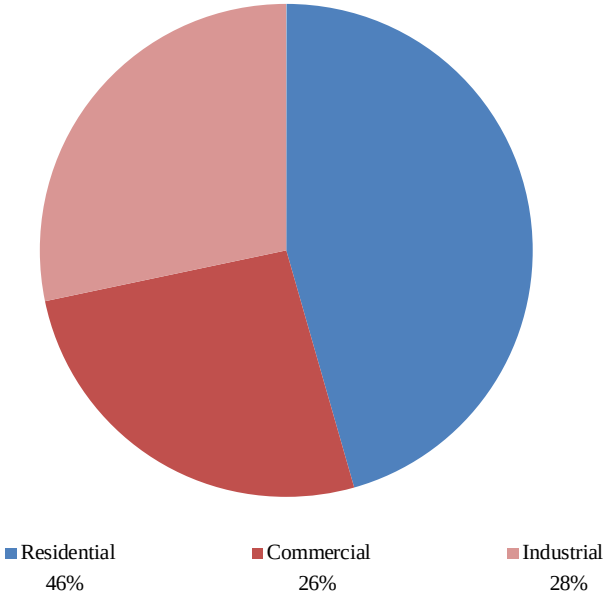
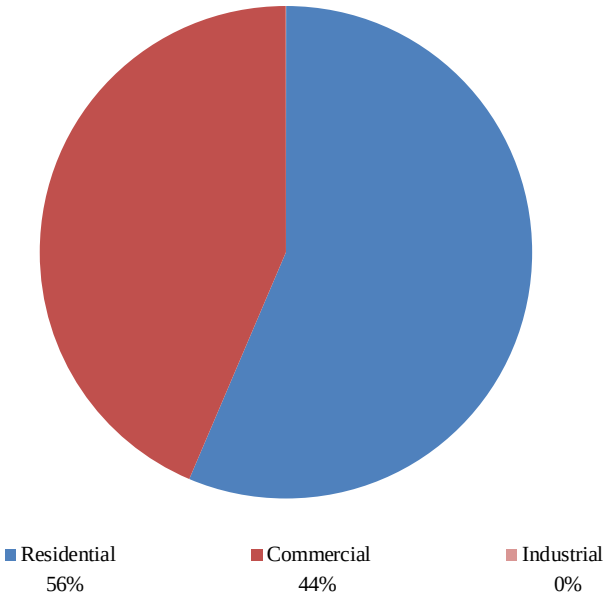
Nevada

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Nevada Electric Revenues by Customer Class



Nevada Energy Efficiency Spending by Customer Class



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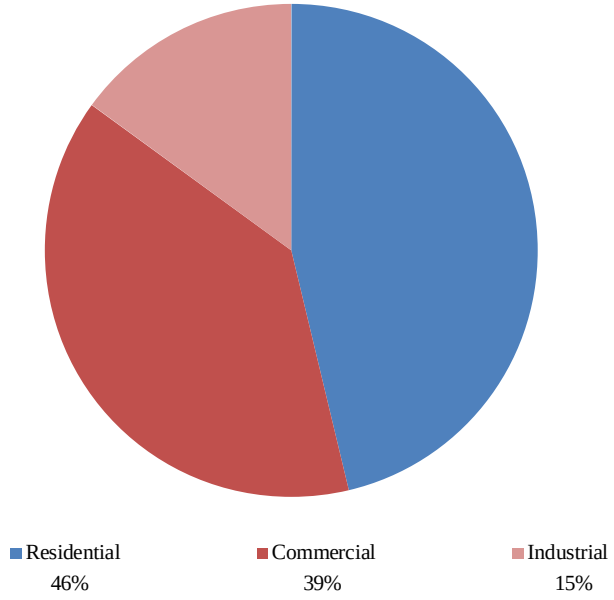
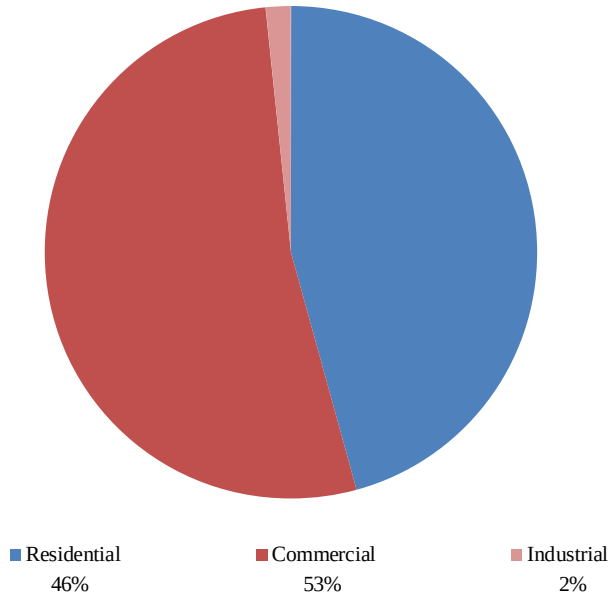
New Hampshire

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

New Hampshire Electric Revenues by Customer Class



New Hampshire Energy Efficiency Spending by Customer Class



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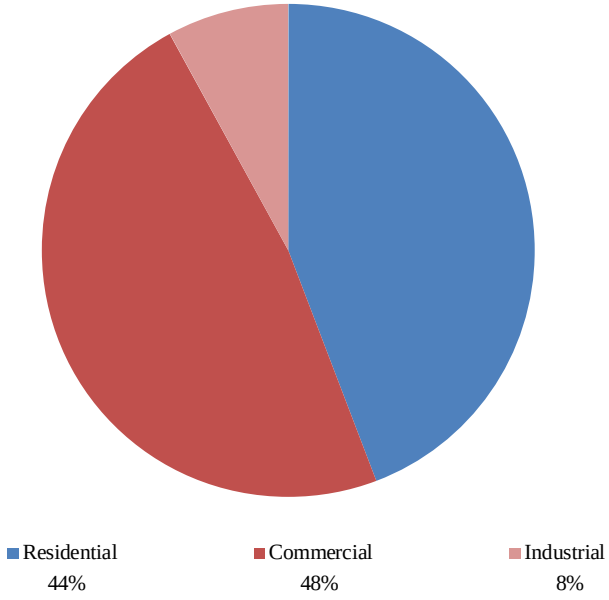
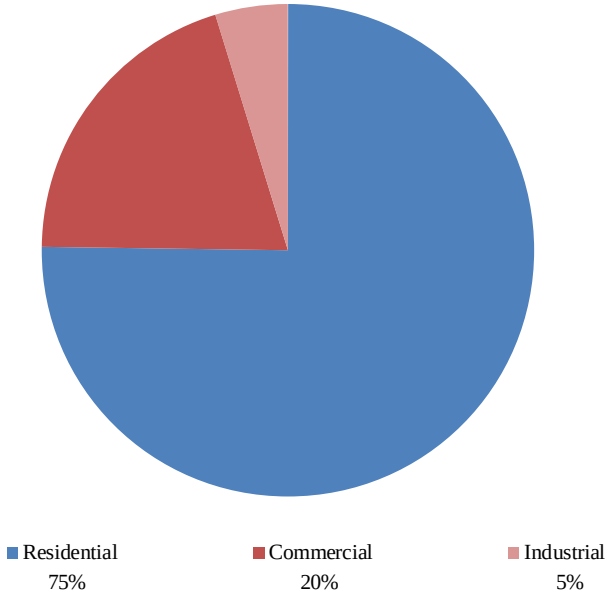
New Jersey

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

New Jersey Electric Revenues by Customer Class



New Jersey Energy Efficiency Spending by Customer Class



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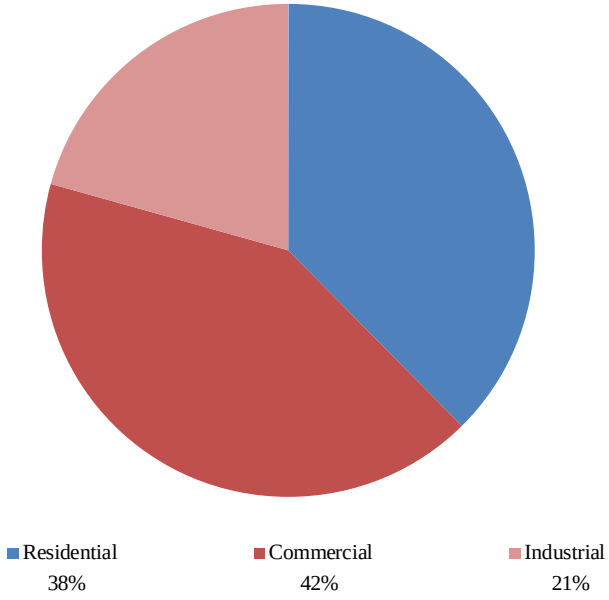
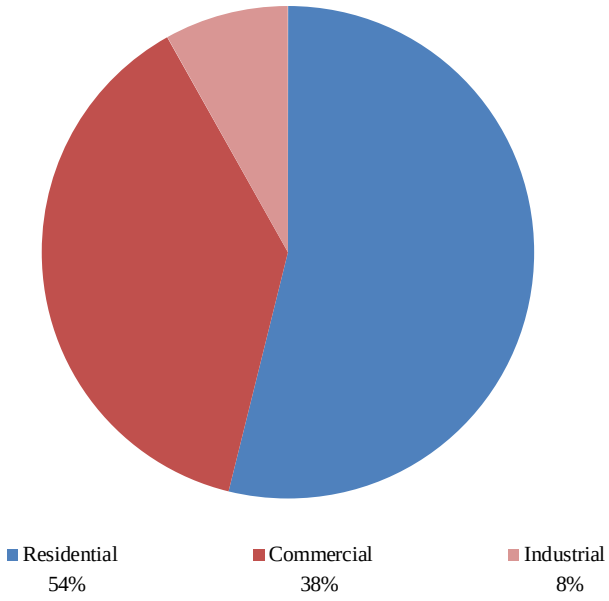
New Mexico

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

New Mexico Electric Revenues by Customer Class



New Mexico Energy Efficiency Spending by Customer Class



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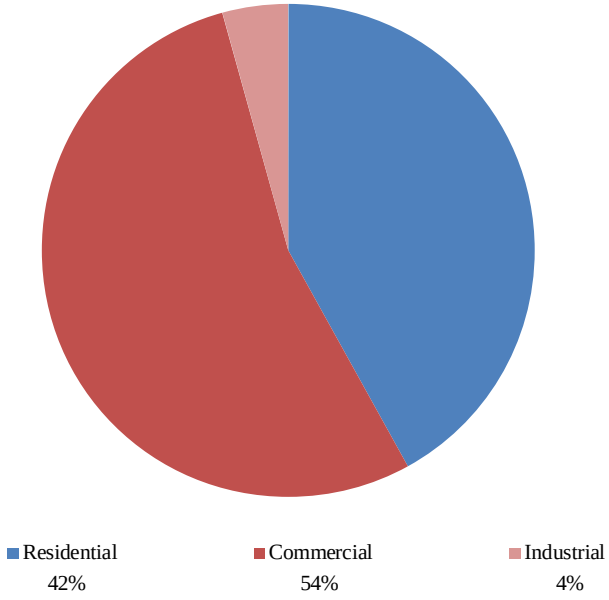
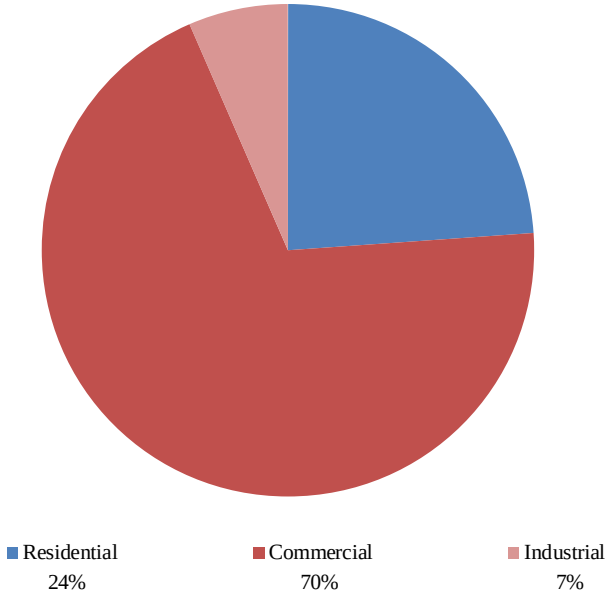
New York

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

New York Electric Revenues by Customer Class



New York Energy Efficiency Spending by Customer Class



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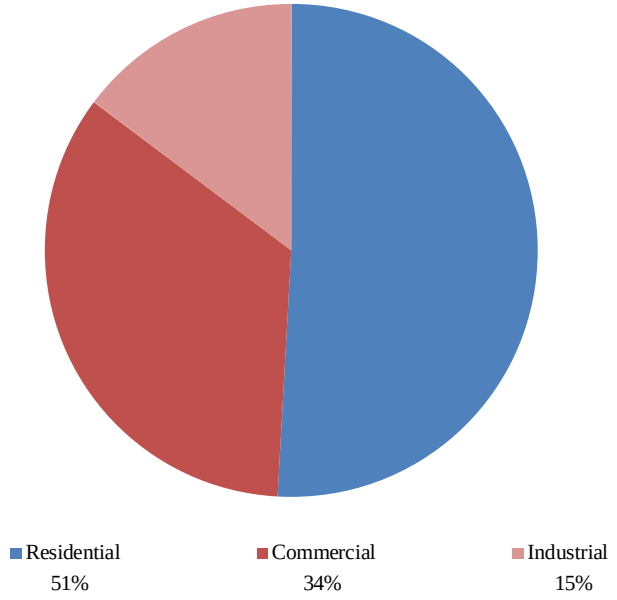
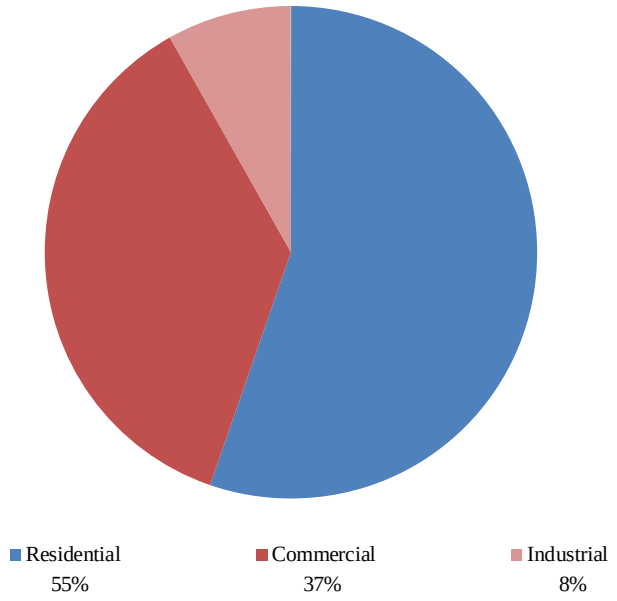
North Carolina

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

North Carolina Electric Revenues by Customer Class



North Carolina Energy Efficiency Spending by Customer Class



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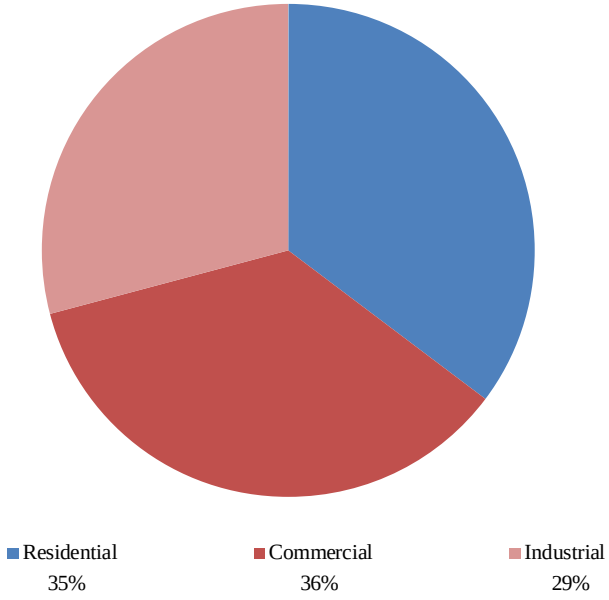
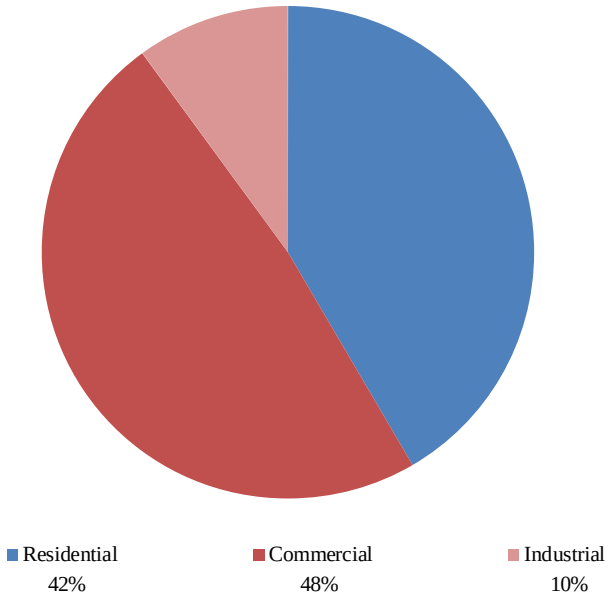
North Dakota

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

North Dakota Electric Revenues by Customer Class



North Dakota Energy Efficiency Spending by Customer Class



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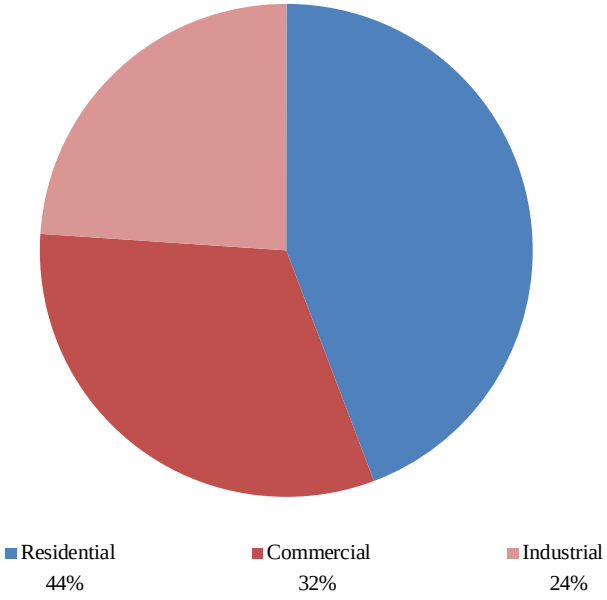
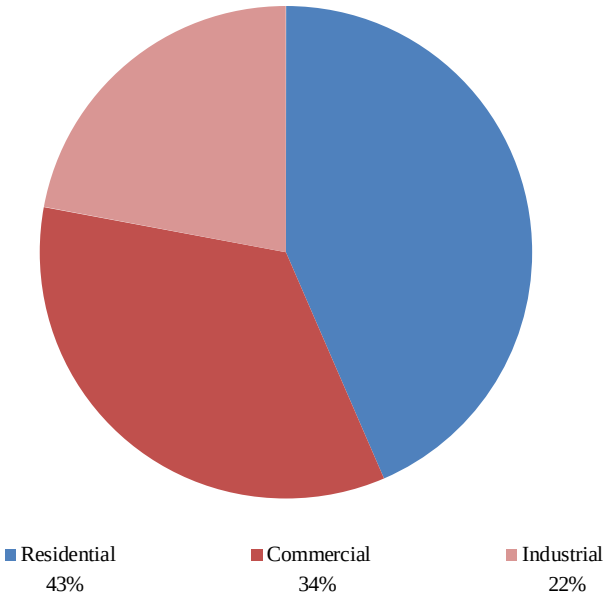
Ohio

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Ohio Electric Revenues by Customer Class



Ohio Energy Efficiency Spending by Customer Class



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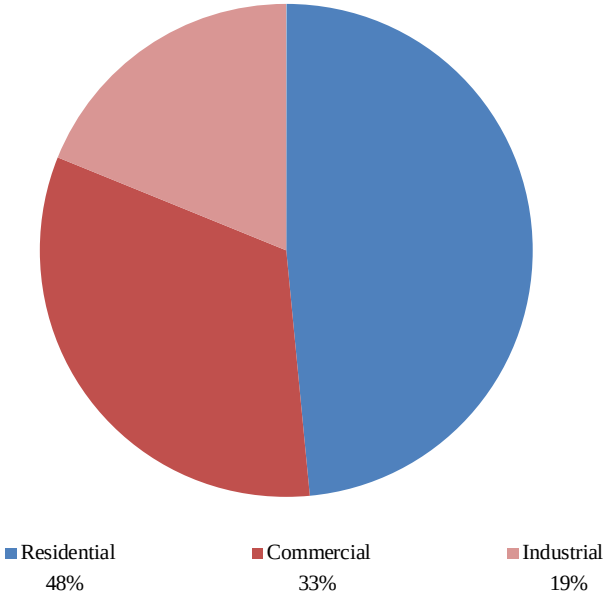
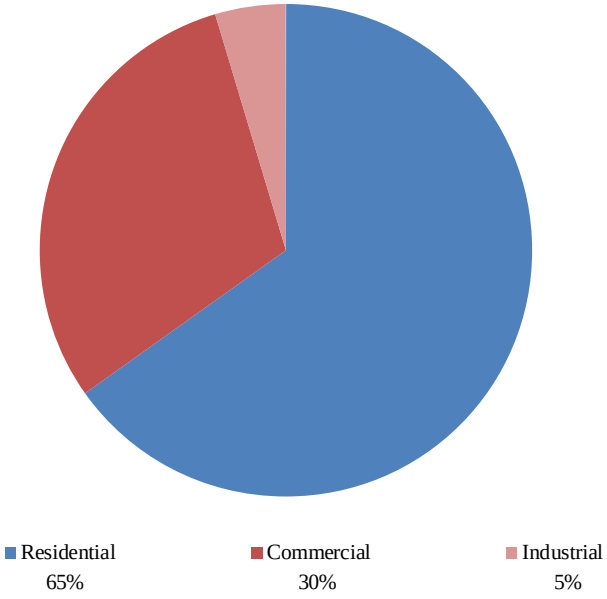
Oklahoma

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Oklahoma Electric Revenues by Customer Class



Oklahoma Energy Efficiency Spending by Customer Class



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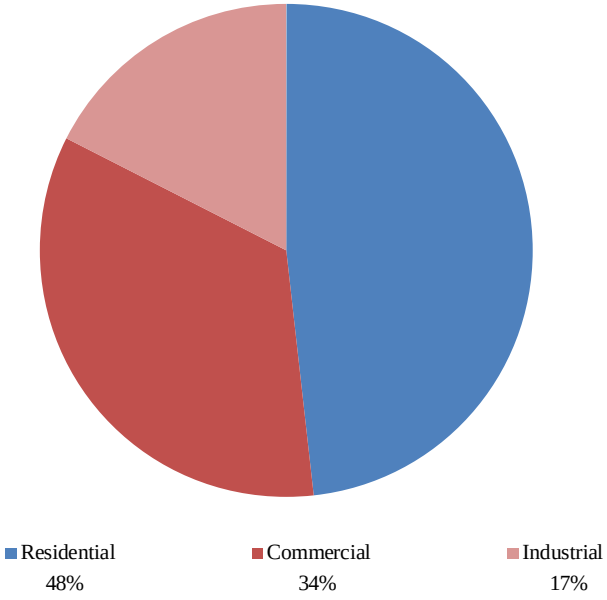
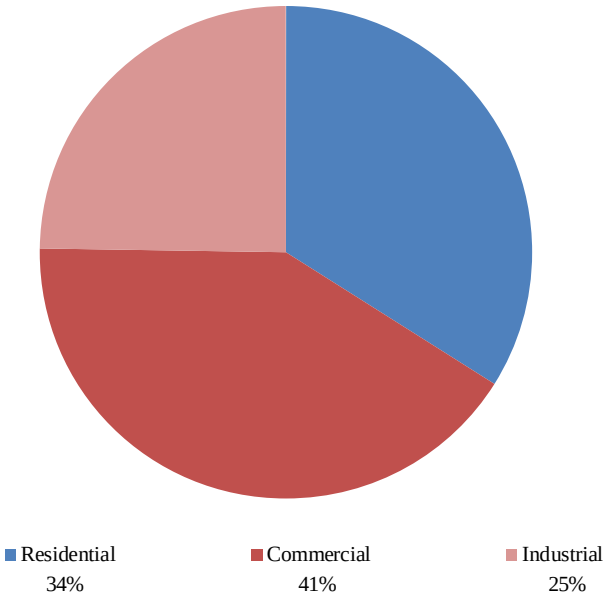
Oregon

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Oregon Electric Revenues by Customer Class



Oregon Energy Efficiency Spending by Customer Class



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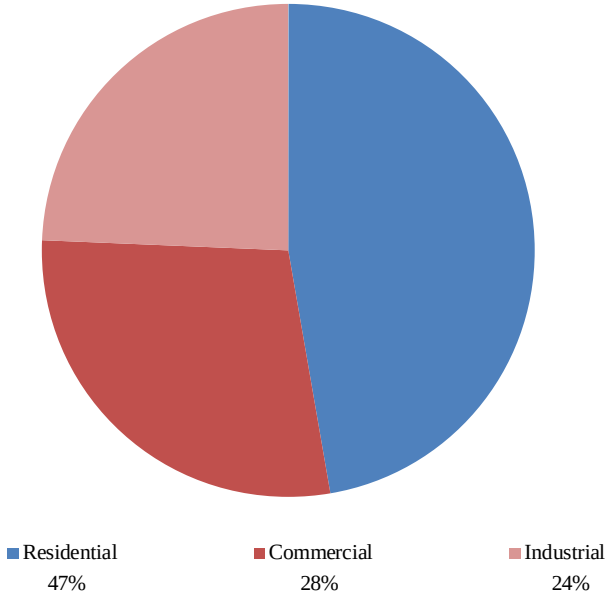
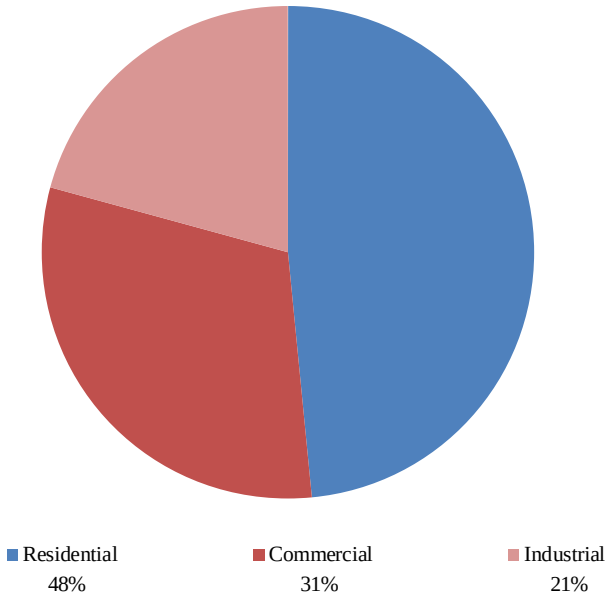
Pennsylvania

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Pennsylvania Electric Revenues by Customer Class



Pennsylvania Energy Efficiency Spending by Customer Class



Notes & Sources:

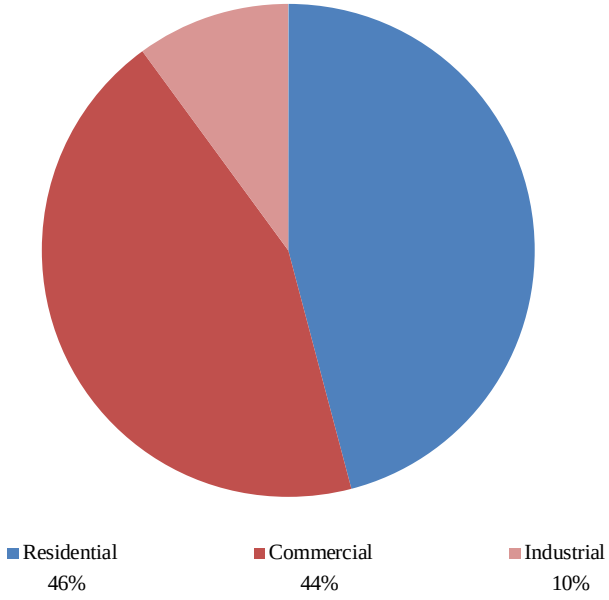
[1] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed May 10, 2014.

[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

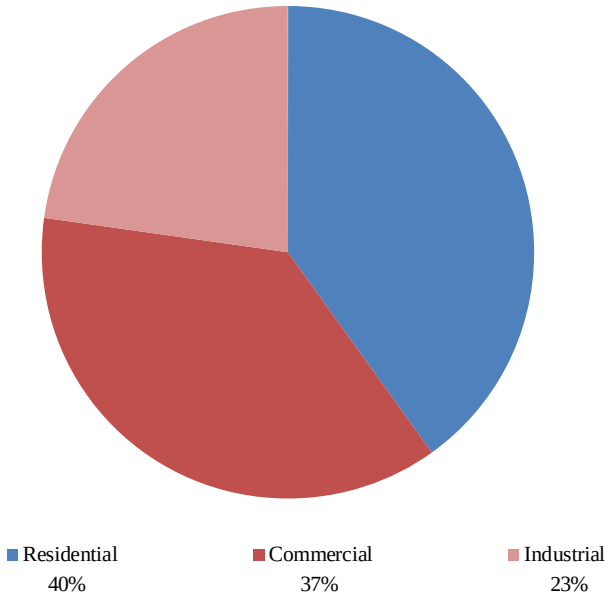
Rhode Island

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Rhode Island Electric Revenues by Customer Class



Rhode Island Energy Efficiency Spending by Customer Class



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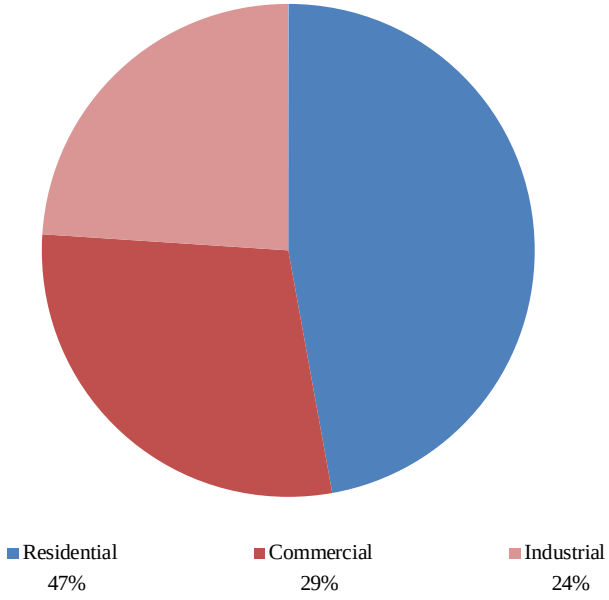
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

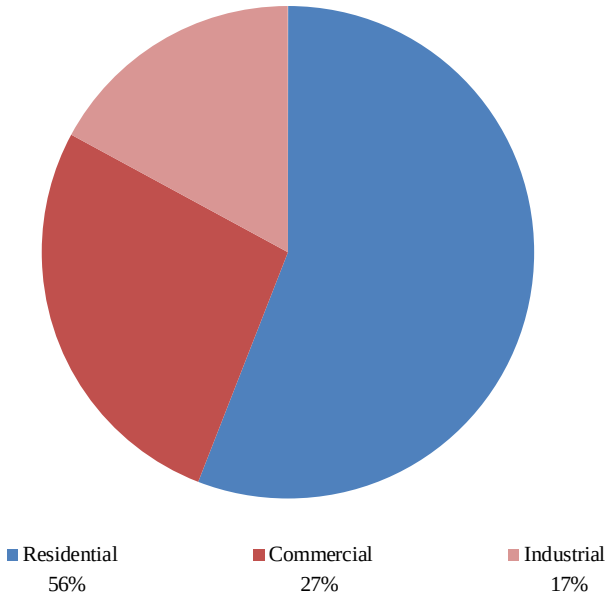
South Carolina

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

South Carolina Electric Revenues by Customer Class



South Carolina Energy Efficiency Spending by Customer Class



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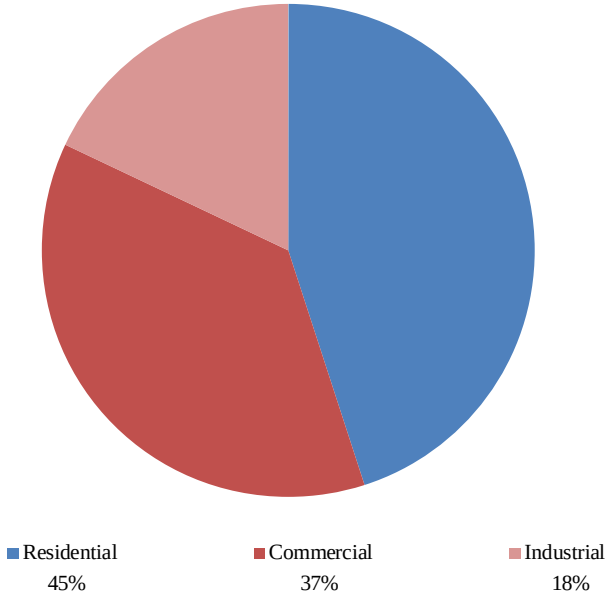
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

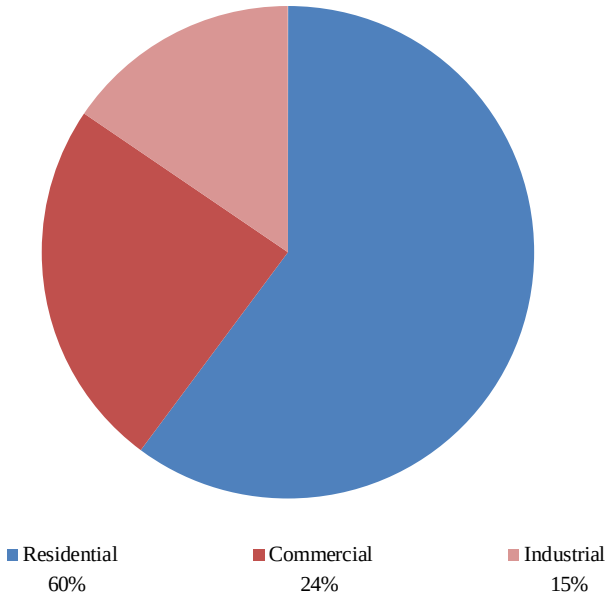
South Dakota

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

South Dakota Electric Revenues by Customer Class



South Dakota Energy Efficiency Spending by Customer Class



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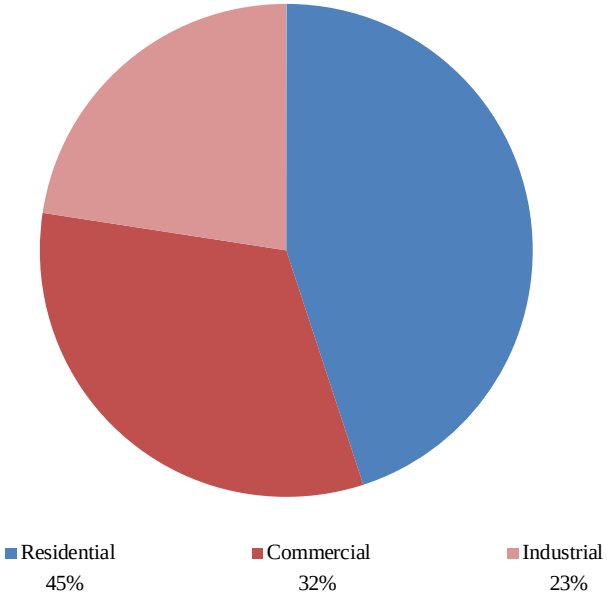
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

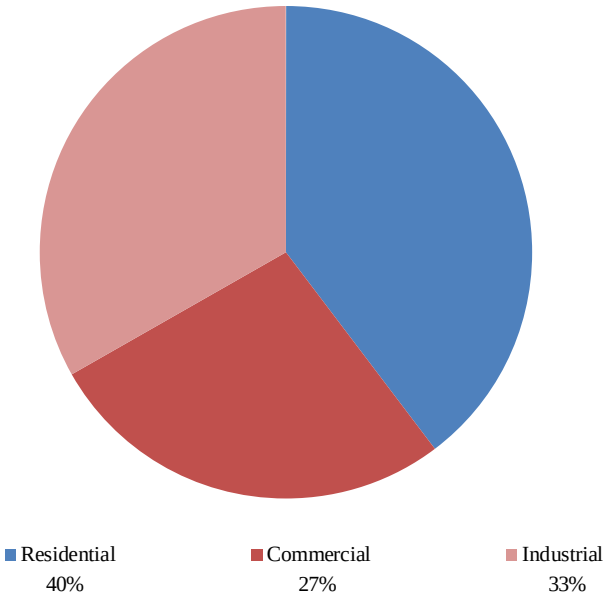
Tennessee

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Tennessee Electric Revenues by Customer Class



Tennessee Energy Efficiency Spending by Customer Class



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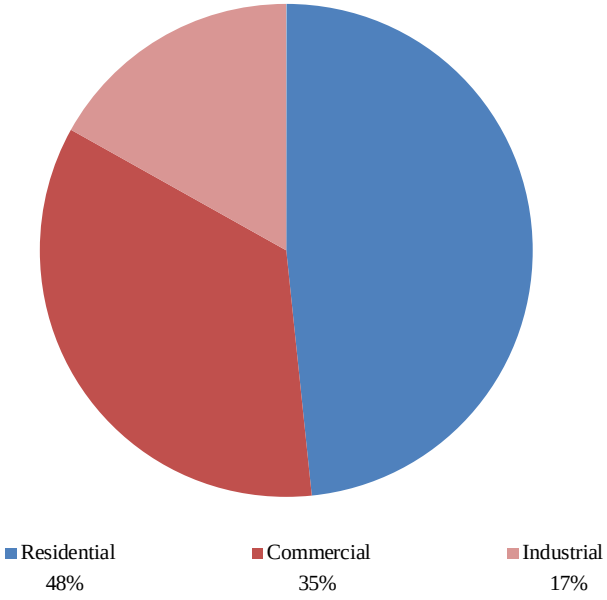
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

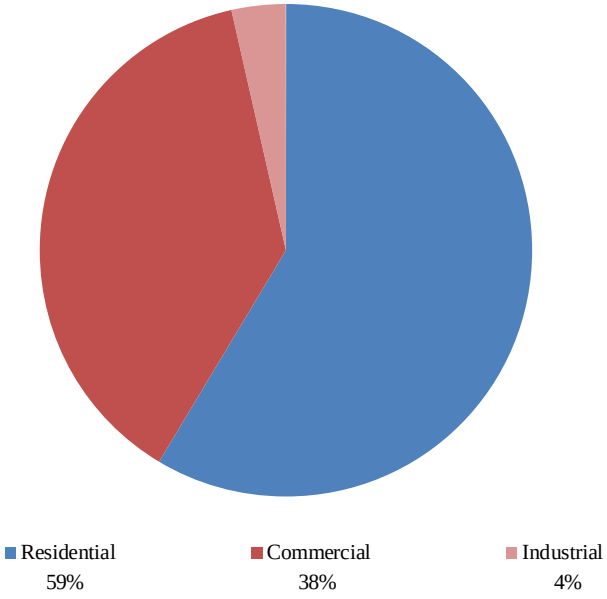
Texas

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Texas Electric Revenues by Customer Class



Texas Energy Efficiency Spending by Customer Class



Notes & Sources:

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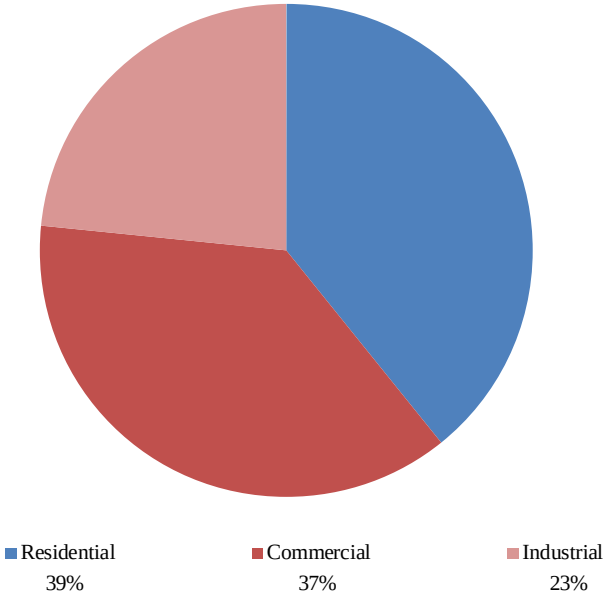
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

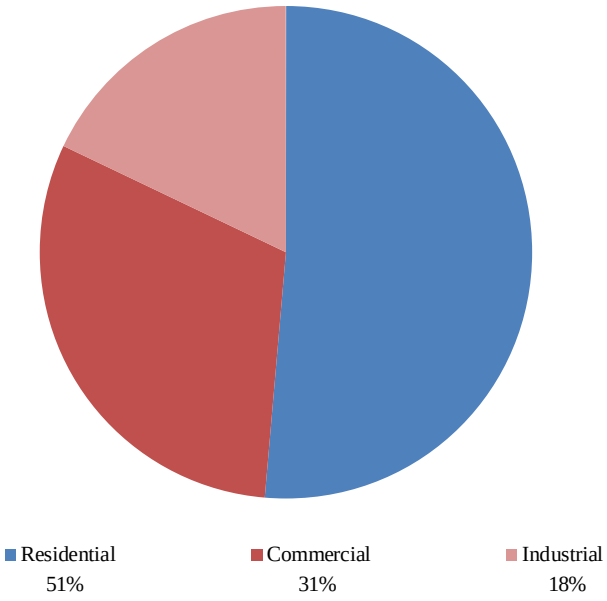
Utah

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Utah Electric Revenues by Customer Class



Utah Energy Efficiency Spending by Customer Class



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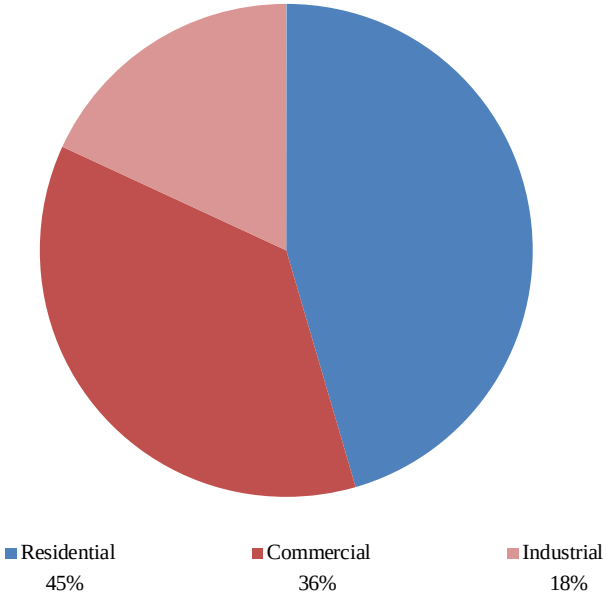
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

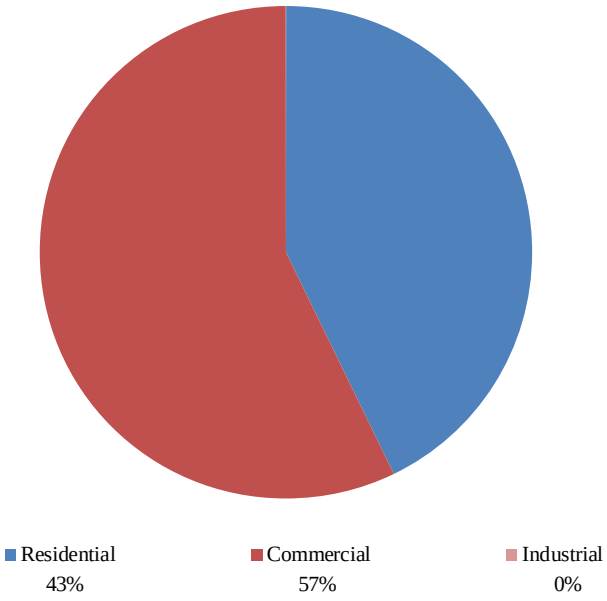
Vermont

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Vermont Electric Revenues by Customer Class



Vermont Energy Efficiency Spending by Customer Class



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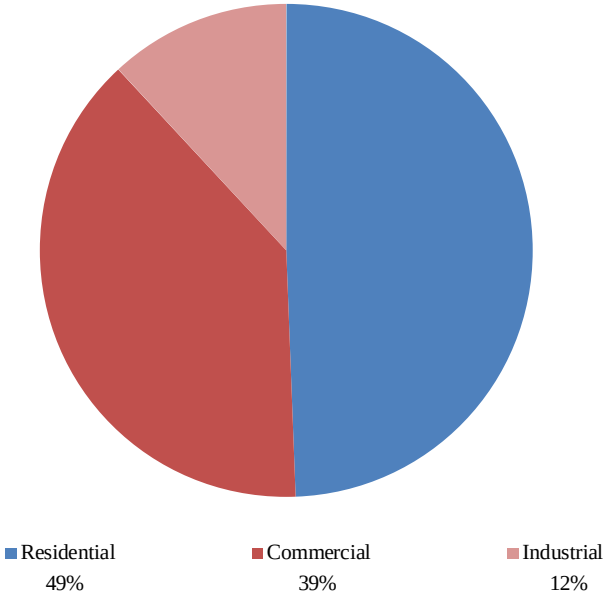
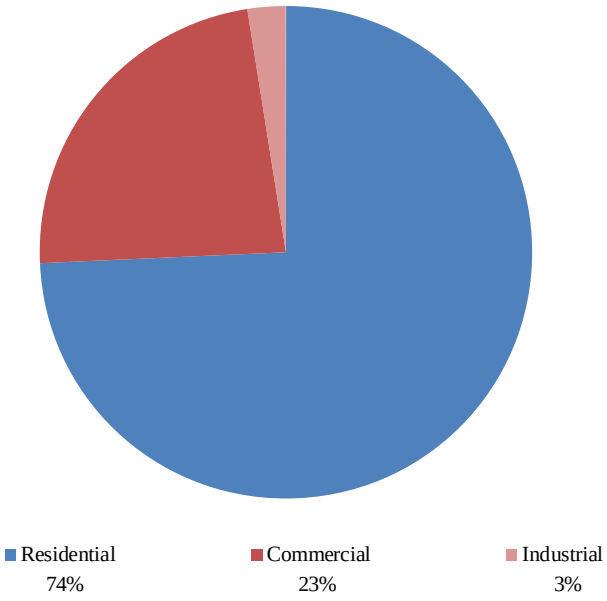
Virginia

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Virginia Electric Revenues by Customer Class



Virginia Energy Efficiency Spending by Customer Class



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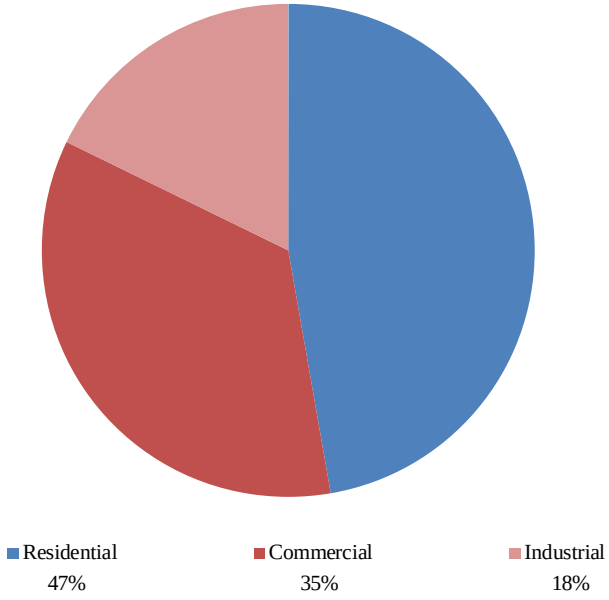
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

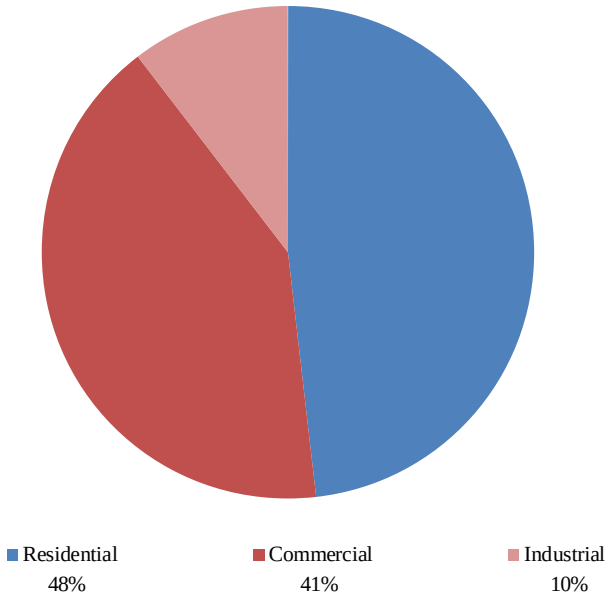
Washington

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Washington Electric Revenues by Customer Class



Washington Energy Efficiency Spending by Customer Class



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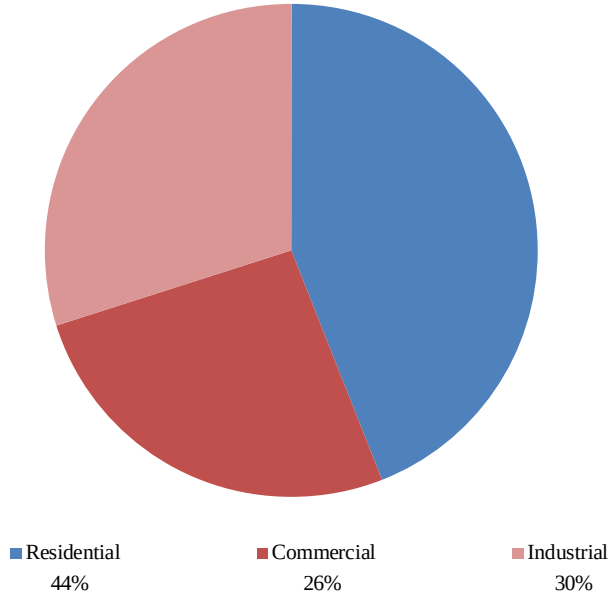
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

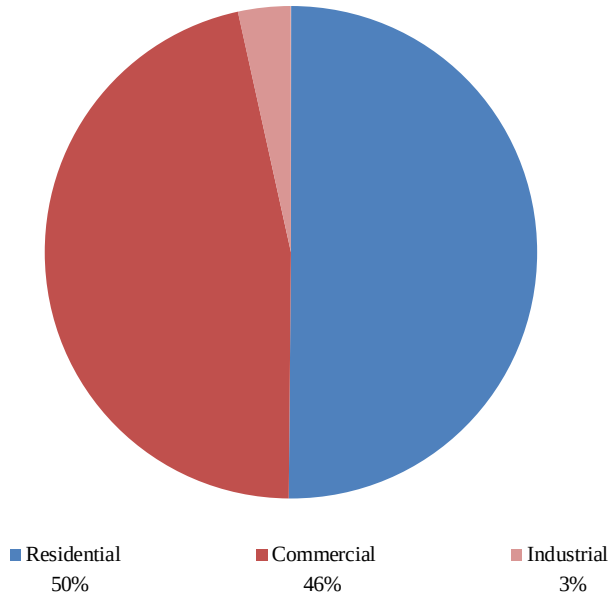
West Virginia

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

West Virginia Electric Revenues by Customer Class



West Virginia Energy Efficiency Spending by Customer Class



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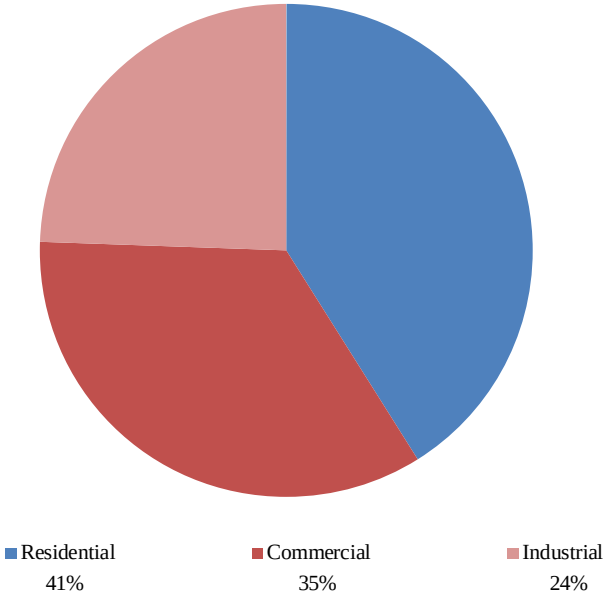
[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

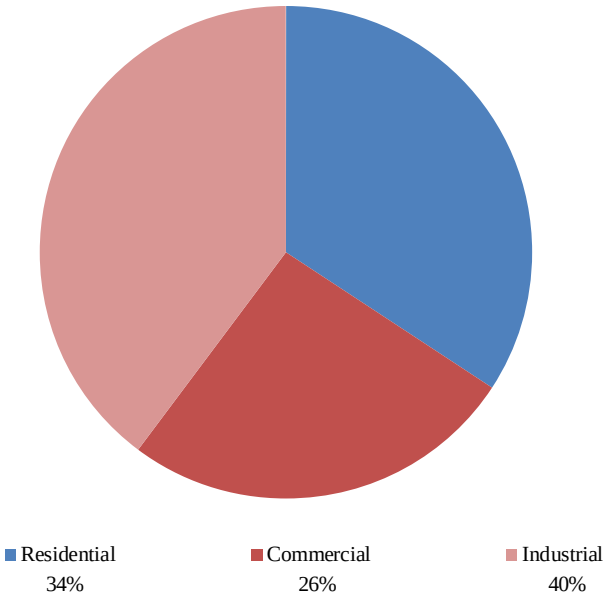
Wisconsin

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Wisconsin Electric Revenues by Customer Class



Wisconsin Energy Efficiency Spending by Customer Class



Notes & Sources:

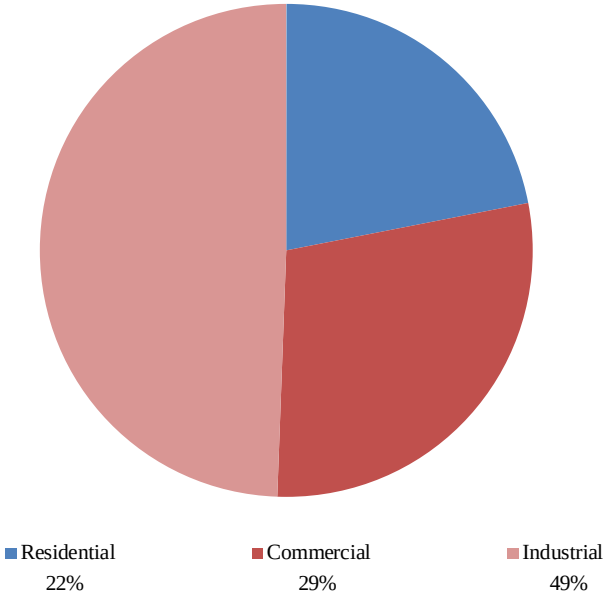
[1] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed May 10, 2014.

[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

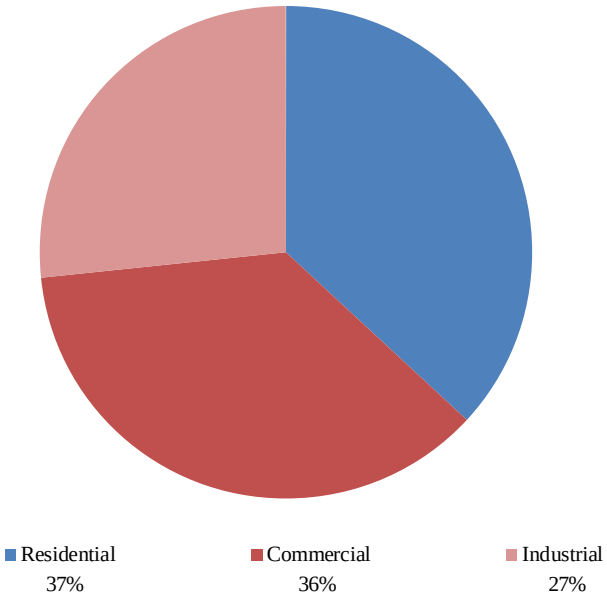
Wyoming

Comparison of Customer Class Electric Revenues and Energy Efficiency Spending by State (2012)

Wyoming Electric Revenues by Customer Class



Wyoming Energy Efficiency Spending by Customer Class



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[2] Energy efficiency spending includes costs associated with both Energy Efficiency and Load Management Programs as reported in EIA data.

APPENDIX 4

State Case Studies
(For the States Shown in Shading Below)

ARIZONA

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
  - Low-income considerations for DSM charges
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Commission has overseen the collection of system benefit charges for 15 years
  - Individual utilities administer their system benefit charges and related programs
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues from residential customers are spent in rough proportion to the dollars collected from that rate class
  - Energy efficiency spending in 2012 was 48% residential and 52% commercial
- **Protection of low-income customers**
  - Utilities must allocate a portion of demand side management (DSM) resources to low-income customers
  - Ratepayer-funded low-income programs totaled $33.4 million toward rate assistance and $3.9 million toward energy efficiency in 2012
  - Utilities offer rate assistance and energy efficiency programs
  - Charitable rate assistance programs also exist
  - LIHEAP funding in 2014: $23,641,470

State ratemaking practices:

In Arizona, showing that rates are fair and reasonable across different customer classes is an important part of setting rates. In a recent Arizona Rate Case, Tucson Electric Power Company (TEP) used a Customer Class Cost of Service Study (CCCSS) to compare the reasonableness of the Settlement Agreement at issue. TEP argued that "the revenue allocation under the Settlement Agreement is equitable, while gradually moving towards matching customer classes to their actual costs."[1]

Arizona law states that all public service corporations that provide electric service to retail customers in Arizona must develop DSM programs for residential, non-residential, and low-income customers, which should be funded by a non-bypassable mechanism. The law states that funds should be collected "from residential customers and from non-residential customers proportionately to those customer classes to the extent practicable," and that costs for low-income customers "shall be borne by all customer classes, except where a customer or customer class is specifically exempted by Commission order."[2] Furthermore, the law states that affected utilities must "allocate a portion of DSM resources specifically to low-income customers."[3]

[1] Arizona Corporation Commission Rate Case Docket E-01933A-12-0291, Docketed June 27, 2013.
[2] Arizona Administrative Code (AAC) R14-2-2401; AAC R14-2-2408.
[3] AAC R14-2-2403.

Collection of energy efficiency (and other) public benefit revenues:

In 1999, the Arizona Corporation Commission ordered utilities to assess a non-bypassable system benefits charge on customers in order to fund low-income assistance, energy efficiency, and renewable resource programs. Oversight is provided by the Arizona Corporation Commission, while programs are administered by individual utilities.[4]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Arizona in 2012 was distributed in the following way: 48% of spending was on residential customers and 52% was on commercial customers.[5] Energy efficiency spending on residential customers is in rough proportion to the electric revenues collected from that rate class.[6]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Arizona, funding for 2014 totaled $23,641,470. Customers whose income is not greater than 60% of the state median income (or 150% of the Federal Poverty Level for households with 8 or more people) are LIHEAP-eligible. An estimated 28,781 households benefited from LIHEAP heating and cooling assistance in 2013. Eligible customers receive between $75 and $640 in heating and cooling benefits.[7]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists a total of $33.4 million in ratepayer funds dedicated toward low-income rate assistance, and $3.9 million in ratepayer funds dedicated toward low-income energy efficiency.[8] These numbers include totals from state- and utility-administered programs.

Many utilities offer utility-funded rate assistance programs and energy efficiency programs for low-income customers. Generally, utilities administer their rate assistance programs and contract with local community action agencies for their energy efficiency program. Examples of programs offered by Arizona Public Service are below:

- Arizona Public Service offers ratepayer assistance and crisis bill assistance funded by a volumetric "System Benefits Adjustment" on customers' bills. Their Energy Support Program (ESP) offers up to 65% off on the cost of electricity for eligible low-income customers, and their Crisis Bill Assistance (CBA) offers up to $400 per year for eligible customers with financial hardship. The CBA is administered by the Arizona Community Action Association. Funding in 2012 was $18.2 million for ESP and $254,000 for CBA.
- Arizona Public Service also offers an Energy Wise Low-Income Weatherization (EW) Program which is funded by an "Environmental Improvement Surcharge" paid by all non-low-income

[4] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[5] Percentages reflect EE and Load Management Program costs from EIA data.
[6] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2012.
[7] LIHEAP Clearinghouse Arizona Profile, available at http://liheap.ncat.org/profiles/Arizona.htm, accessed June 4, 2014.
[8] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 4, 2014.

customers. Services include attic insulation, testing of heating and cooling equipment, and water efficiency measures, among other energy efficiency measures. Funding in 2012 for EW totaled $2.12 million.[9]

In addition to ratepayer-funded programs, many utilities offer charitable rate assistance. For example, Trico Electric Cooperative, Sulphur Springs Valley Electric Coop, and Mohave Electric Coop all collected customer donations that go toward helping in-need customers pay their electric bills.[10]

[9] LIHEAP Clearinghouse Arizona State Snapshot, available at http://liheap.ncat.org/dereg/states/azsnapshot.htm, accessed June 4, 2014.
[10] LIHEAP Clearinghouse Arizona Profile, available at http://liheap.ncat.org/profiles/Arizona.htm, accessed June 4, 2014.

CALIFORNIA

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Commission has overseen the collection and spending of public benefit funding mechanisms for 18 years
  - Public benefit funding collected from all rate classes, and all customers within rate classes, on a volumetric basis
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 41% residential, 47% commercial, and 12% industrial
- **Protection of low-income customers**
  - Low-income rates and programs are protected with oversight of the Low-Income Oversight Board
  - Ratepayer-funded low-income programs totaled $1.2 billion toward rate assistance and $250 million toward energy efficiency in 2012
  - "The Big Four" IOUs, municipals and coops, and smaller utilities offer ratepayer funded rate assistance and energy efficiency programs
  - Utilities also offer rate assistance programs through charitable organizations
  - LIHEAP funding in 2014: $153,591,640

State ratemaking practices:

Enacted in 1988, the California Public Utilities Code, Division 1, Part 1, Chapter 4, 739.6 states, "The commission shall establish rates using cost allocation principles that fairly and reasonably assign to different customer classes the costs of providing service to those customer classes, consistent with the policies of affordability and conservation."[1] In addition to providing provisions relating to equity across customer classes, the PUC code also has provisions to protect conservation and energy efficiency efforts and to protect low-income customers. The PUC Division 1, Part 1, Chapter 4, 739.9 code states that when electric utilities alter their rates for residential customers, "The commission shall ensure that any approved charges do all of the following: (1) reasonably reflect an appropriate portion of the different costs of serving small and large customers. (2) Not unreasonably impair incentives for conservation and energy efficiency. (3) Not overburden low-income customers."[2]

[1] California PUC Division 1, Part 1, Chapter 4, 739.6, effective June 28, 1988.
[2] California PUC Division 1, Part 1, Chapter 4, 739.9, effective January 1, 2014.

Collection of energy efficiency (and other) public benefit revenues:

California established its first public benefit fund in 1996. Called the Public Goods Charge (PGC), the fund was overseen by the California Public Utilities Commission (CPUC) and was non-bypassable. Proceeds from this fund went toward energy efficiency and low-income assistance programs which were administered by individual utilities and renewable energy and RD&D which were administered by The California Energy Commission.[3] DSIRE reports that these rates varied by utility and customer type, but lists the following approximate charges: for Renewables, ~1.6 mills/kWh; for Efficiency, ~5.4 mills/kWh; and for RD&D, ~1.5 mills/kWh. Annual proceeds from the PGC toward renewables averaged $65.5 million annually from 2008-10; for energy efficiency, $228 million annually; and for RD&D, $62.5 million annually.[4]

Legislation had extended collections from the PGC through 2011, but the California legislature did not pass any additional measures to fund the PGC beginning in 2012. In practice, however, the CPUC still has the authority to levy charges for a public benefits fund through the PUC code 381 which has no expiration date. Funds from the new Electric Program Investment Charge Fund (EPICF) will go toward renewable energy and RD&D projects. From 2010-2012, the CPUP approved the use of funds from the Procurement Energy Efficiency Balancing Account (PEEBA) to replace energy efficiency funds previously obtained through the PGC.[5]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in California in 2012 was distributed in the following way: 41% of spending was on residential customers, 47% was on commercial customers, and 12% was on industrial customers.[6] This is in rough proportion to the electric revenues collected from each rate class.[7]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For California, funding for 2014 totaled $153,591,640. Customers whose income is not greater than 60% of the state median income are LIHEAP-eligible. An estimated 194,189 households benefited from LIHEAP heat assistance in 2013. As an example, the average money spent on heating for LIHEAP customers in 2012 was $424. In addition, 2012 customers could receive up to $1,000 to deal with a crisis.[8]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists a total of $1.2 billion in ratepayer funds dedicated toward low-income rate assistance, and $250

[3] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[4] California Public Benefits Fund Page, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA05R&re=1&ee=1, accessed June 4, 2014.
[5] California Public Benefits Fund Page, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA05R&re=1&ee=1, accessed June 4, 2014.
[6] Percentages reflect EE and Load Management Program costs from EIA data.
[7] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2014.
[8] LIHEAP Clearinghouse California Profile, available at http://liheap.ncat.org/profiles/California.htm, accessed June 4, 2014.

million in ratepayer funds dedicated toward low-income energy efficiency.[9] These numbers include totals from state- and utility-administered programs.

California has several ratepayer funded low-income assistance programs that are administered by utilities with regulatory oversight. Participating utilities include the state's large Investor-Owned Utilities (IOUs) as well as several smaller utilities, and programs are funded through a "public purpose surcharge on all regulated utilities," in which all customers contribute, except for those who qualify for CARE (see below). Several of such programs are listed below:

- The California Alternate Rates for Energy (CARE) provides a 20% discount on gas and electric utility bills for qualifying low-income households. Funding from the state's largest utilities totaled $1.2 billion in 2012.
- The Family Electric Rate Assistance Program provides an additional electric rate discount for qualifying low-income households for customers of the state's largest electric IOUs. Funding from these IOUs totaled $11 million in 2012.
- The Energy Savings Assistance Program (formerly Low Income Energy Efficiency or LIEE) funds the "Repair and replacement of gas and electric heating and water heating systems, air conditioners and evaporative coolers, refrigerator and lighting upgrades, weatherization and energy efficiency education." Funding from the state's largest utilities totaled $250.6 million in 2012.[10]

In addition to the above ratepayer funded utility-administered programs, smaller utilities and municipal utilities offer low-income rate assistance and energy efficiency programs. A few examples are below:

- Sacramento Municipal Utility District (SMUD) has several programs to help with rate assistance, including a payment program for overdue utility bills and the Energy Assistance Program Rate (EAPR) where qualifying customers can receive a discount of more than 30% on their energy bill. SMUD also offers a Medical Equipment Discount Rate for customers with high electric costs resulting from running medical equipment.
- Alameda Municipal Power's Energy Assistance Program (EAP) is an intervention program that provides a "one-year 25 percent electric rate reduction home energy audit," along with a replacement of certain appliances and weatherization for homes with electric heat. They also offer a Medical Discount Program for customers not benefitting from EAP that offers a 10% discount for customers running energy-intensive health devices.
- The Banning Electric Alternative Rate Program in the City of Banning is funded by the state-mandated electric public benefits charge and results in up to $200 annual savings on eligible customers' electric utility bill.[11]

[9] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 4, 2014.
[10] LIHEAP California State Snapshot, available at http://liheap.ncat.org/dereg/states/casnapshot.htm, accessed June 4, 2014.
[11] LIHEAP Clearinghouse California Profile, available at http://liheap.ncat.org/profiles/California.htm, accessed June 4, 2014.

Many utilities also offer charitable assistance, funded through organizations like the Salvation Army or through donations and subsidies from shareholders, employees, and/or customers. A few examples are listed below:[12]

- SMUD offers EnergyHELP which provides eligible low-income customers with up to $200 in yearly assistance toward unpaid bills. This program is offered in conjunction with The Salvation Army, Sacramento Food Bank Services, Travelers Aid and Folsom Cordova Community Partnership.
- San Diego Gas and Electric's Neighbor to Neighbor program is subsidized by shareholders and employees and helps customers experiencing temporary financial hardship to pay their bills.
- Los Angeles Department of Water and Power offers rate assistance to low-income and unemployed elderly customers through funds collected from customers and city employees.

As an additional measure to protect low-income utility customers, the California legislature established the Low Income Oversight Board to advise the PUC on their low-income programs and to serve as a liaison between low-income customers and representatives.[13]

[12] LIHEAP Clearinghouse California Profile, available at http://liheap.ncat.org/profiles/California.htm, accessed June 4, 2014.
[13] See the LIOB website, available at http://www.liob.org/, accessed June 4, 2014.

COLORADO

Summary

- **State ratemaking practices**
  - Fair and reasonable allocation of utility costs to customers
  - Equitable allocation of DSM costs to all customer classes
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Commission oversaw the collection and spending of funds collected from Xcel energy from 2004-2013
  - The City of Boulder collects funds from all customers, on a volumetric basis with varying rates based on customer class
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 35% residential, 54% commercial, and 11% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $5.47 million toward rate assistance and $6.33 million toward energy efficiency in 2012
  - Utilities offer ratepayer-funded rate assistance, arrears management, and energy efficiency programs
  - Utilities also offer charitable rate assistance programs
  - LIHEAP funding in 2014: $46,377,830

State ratemaking practices:

Colorado law demands that rates charged by utilities be fair to customers. As summarized in the Colorado Revised Statutes, §40-3-101.1, "All charges made, demanded, or received by any public utility for any rate, fare, product, or commodity furnished or to be furnished or any service rendered or to be rendered shall be just and reasonable."[1] In addition, the Public Utilities Commission (PUC) takes into account low-income customers when setting rates. Specifically, the Colorado Department of Regulatory Agencies PUC code states, "Electric utilities with Colorado retail customers shall file with the Commission a proposal to provide low-income energy assistance by offering rates, charges, and services that grant a reasonable preference or advantage to residential low-income customers," which is permitted by CRS §40-3-106.[2]

In 2007, the General Assembly of the State of Colorado amended the CRR §40-1-102 to declare that cost-effective Demand-Side Management Programs (DSMs), which include any combination of energy efficiency, energy conservation, load management, and demand response programs, "will save money for

[1] Colorado Revised Statutes §40-3-101.1, effective April 19, 2013.
[2] Colorado Department of Regulatory Agencies PUC CCR 723-3, Part 3.

consumers and utilities and protect Colorado's environment." As utilities develop their DSM programs and implement incentive mechanisms, which can include cost-adjustment, the Commission "shall ensure that utilities develop and implement DSM programs that give all classes of customers an opportunity to participate and shall give due consideration to the impact of DSM programs on Nonparticipants and on low-income customers."[3]

Collection of energy efficiency (and other) public benefit revenues:

While Colorado does not have a true Public Benefits Fund, Xcel Energy agreed to spend $196 million on energy efficiency programs from 2004 to 2013 as part of a settlement and levied a charge on customers to recover these costs. The utility administered these funds, which were collected for energy efficiency and load management programs, and the PUC served as the oversight body.[4]

Additionally, in 2006 citizens of the City of Boulder voted in favor of a tax levied on electricity customers in the form of a charge based on electric usage. Proceeds go to programs to increase energy efficiency, increase renewable energy, and decrease motor vehicle emissions. Maximum tax rates for electricity customers as reported in DSIRE are as follows: for residential customers, $0.0049/kWh; for commercial customers, $0.0009/kWh; and for industrial customers, $0.0003/kWh. In 2010, proceeds from this tax totaled $1.8 million.[5]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Colorado in 2012 was distributed in the following way: 35% of spending was on residential customers, 54% was on commercial customers, and 11% was on industrial customers.[6] This is in rough proportion to the electric revenues collected from each rate class.[7]

Protection of low-income customers:

As mentioned above, there are laws in place to protect low-income customers when it comes to the setting of utility rates. In addition, federally-funded LIHEAP funds go toward protecting low-income utility customers. Colorado LIHEAP funds for 2014 totaled $46,377,830, and benefit customers who are below 150% of the Federal Poverty Level. In Colorado, this money is spent on heating, with an average spending in 2013 of $302 per household.[8]

The LIHEAP Clearinghouse additionally also compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent Colorado data from 2012 lists a total of $5.47 million in ratepayer funds dedicated toward low-income rate assistance, and $6.33 million in ratepayer funds dedicated toward low-income energy efficiency.[9]

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[3] CRS §40-1-102 as Amended by House Bill 07-1037, effective 2007.
[4] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[5] City of Boulder – Climate Action Plan Fund webpage, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CO37R&re=1&ee=1, accessed June 4, 2014.
[6] Percentages reflect EE and Load Management Program costs from EIA data.
[7] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2014.
[8] LIHEAP Clearinghouse State Profile, available at http://liheap.ncat.org/profiles/Colorado.htm, accessed June 4, 2014.
[9] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 4, 2014.

Individual utilities have low-income programs that include some combination of rate assistance, arrears management, and energy efficiency. Many of these programs are administered in partnership with Colorado LIHEAP and/or Energy Outreach Colorado[10], a non-profit that helps raise funds to help low-income Coloradans meet their energy needs.[11] A few examples of programs offered by Colorado utilities are provided below:

- Black Hills Energy offers a Black Hills Energy Assistance Program (BHEAP) and Low-Income Weatherization (LIWAP) Program.
    - BHEAP is administered in partnership with Colorado LIHEAP, and qualifying customers receive both rate assistance through a fixed monthly credit on customers' bills and a monthly arrearage credit equal to 1/24 of the pre-existing arrearage. This program is funded through a "BHEAP Funding Fee" charged to all customers.
    - LIWAP is administered through partnership with community action agencies, and qualifying customers receive weatherization services such as refrigerator replacement and evaporative cooler installations. This program is funded through a "Demand-Side Management Cost Adjustment" charge to all customers.
    - Estimated 2012 funding for BHEAP was $234,000 and for LIWAP was $424,000.
- Xcel Energy also offers low-income rate assistance, arrears management, and energy efficiency programs.
    - The Electric Affordability Program (EAP) is administered in partnership with Colorado LIHEAP and provides several options for rate-assistance and arrears management for qualifying customers. For rate assistance, the Percentage of Income Payment Plan (PIPP) allows customers to receive a bill credit related to the difference between their customer bill and 3% of their annual income, while the Step Bill Discount (SBD) gives qualifying households a percentage discount based on their last twelve months of energy usage. For arrears management, PIPP credits are designed to eliminate outstanding balances over the course of 12 or 24 months, while SBD provides a one-time credit of up to $200 to arrears. The cost of EAP is built into the "Service and Facility Charge" charged to all customers. Estimated 2012 funding for EAP was $6.4 million.
    - The Low-Income Segment (LIS) is a low-income energy efficiency program that is administered in partnership with the Governor's Energy Office and Energy Outreach Colorado. This program offers services including the distribution of energy-saving kits and weatherization assistance, and is funded through a "Demand-Side Management Cost Adjustment" charged to all customers. Estimated 2012 funding for LIS was $5.54 million.[12]

[10] LIHEAP Clearinghouse State Snapshot, available at http://liheap.ncat.org/dereg/states/cosnapshot.htm, accessed June 4, 2014.
[11] See Energy Outreach Colorado About Us webpage, available at http://www.energyoutreach.org/about, accessed June 4, 2014.
[12] LIHEAP Clearinghouse State Snapshot, available at http://liheap.ncat.org/dereg/states/cosnapshot.htm, accessed June 4, 2014.

Many utilities also offer charitable programs to help with rate assistance. A few examples are provided below:

- Black Hills Energy's Black Hills Cares program matches customer and employee donations to the program and provides assistance to eligible customers to pay their energy bills or pay energy-related expenses.
- The City of Longmont's COPE program offers utility bill payment assistance to customers who have a disconnect notice.
- Yampa Valley Electric offers a Caring Customers program, where customers can elect to round their electric bills up to the nearest dollar, and an appointed board of directors determines whom to deliver funds to.[13]

[13] LIHEAP Clearinghouse State Profile, available at http://liheap.ncat.org/profiles/Colorado.htm, accessed June 4, 2014.

CONNECTICUT

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - Separate energy efficiency and renewable energy funds exist
  - The Clean Energy Finance and Investment Authority has overseen the collection and spending of the Connecticut Clean Energy Fund for 16 years
  - The Energy Conservation Management Board has helped the relevant utilities oversee the Connecticut Energy Efficiency Fund for 16 years
  - Public benefit funding collected from all rate classes, and all customers within rate classes, on a volumetric basis
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 48% residential, 40% commercial, and 12% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $20.8 million toward rate assistance and $19.1 million toward energy efficiency in 2012
  - Utilities offer energy efficiency and arrears management programs
  - Charitable fuel assistance programs also exist
  - LIHEAP funding in 2014: $77,412,553

State ratemaking practices:

Connecticut has laws in place to protect utility customers by requiring that rates be fair. In Chapter 277, Section 16-19a of the General Statutes of Connecticut, the law commands that at least once every four years, the Public Utilities Regulatory Authority (the Authority) "conduct a complete review and investigation of the financial and operating records of each such company and hold a public hearing to determine whether the rates of each such company are unreasonably discriminatory or more or less than just, reasonable and adequate" for gas and electric companies of a certain size.[1] In addition to requiring that rates be just and reasonable, there is an additional concern about protecting low-income customers. In particular, Section 16-19e states that "The authority shall determine whether existing or future rate structures place an undue burden upon those persons of poverty status and shall make such adjustment in the rate structure as is necessary or desirable to take account of their indigency."[2]

[1] General Statutes of Connecticut, Chapter 277, Section 16-19a.
[2] General Statutes of Connecticut, Chapter 277, Section 16-19e.

Information from a recent rate case provides an example of the importance of equity in ratemaking practices. The Authority used information obtained from a utility's cost of service study to assess whether the proposed rates were equitable for all customers. In fact, in its Order, the Authority disallowed certain rate proposals made by the utility because the rates were "inexact pricing schemes that inequitably discount bills for one subset of customers to create an opportunity to inequitably overcharge a different subset of customers in the name of price signaling," and that "neither subset of customers is treated equitably." When this happens, the Authority then works with the Company "to implement cost based customer and demand rates across all customer classes."[3]

Collection of energy efficiency (and other) public benefit revenues:

The Connecticut Clean Energy Fund (CCEF) and the Connecticut Energy Efficiency Fund (CEEF) are two Public Benefits Funds created in 1998. The CCEF is administered and governed by the Clean Energy Finance and Investment Authority, and proceeds from the fund go toward investments in renewable energy and alternative fuels produced in Connecticut and used for electricity generation. Ratepayer funds can also "be leveraged to raise private investment and further support renewable and clean energy development in the state." The charge for this fund is "not less than" $0.0001/kWh for Connecticut Light and Power and United Illuminating customers. Revenues for the fund total approximately $20 million annually.[4]

The CEEF has the mission "to advance the efficient use of energy, to reduce air pollution and negative environmental impacts, and to promote economic development and energy security." CEEF is funded by rate surcharges on Connecticut Light and Power and United Illuminating customers. Utilities then develop plans for energy efficiency programs with assistance from the Energy Conservation Management Board. The fund is supplemented by money from other sources, including RGGI and ISO New England's forward capacity market. The charge for this fund is $0.003/kWh for Connecticut Light and Power and United illuminating customers, with varying charges for municipal utility customers. CEEF funds totaled $154 million in 2011, with $130.3 million coming from ratepayer collections.[5]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Connecticut in 2012 was distributed in the following way: 48% of spending was on residential customers, 40% was on commercial customers, and 12% was on industrial customers.[6] This is in rough proportion to the electric revenues collected from each rate class.[7]

Low-income programs:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. LIHEAP funds for Connecticut in 2014 totaled $77,412,553. Funds are available for customers below 150% of the Federal Poverty Level, or 200% of the Federal Poverty Level for certain families with

[3] Connecticut Rate Case 13-01-19, Order Issued August 15, 2013.
[4] Connecticut Clean Energy Fund Page, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CT03R&re=1&ee=1, accessed June 4, 2014.
[5] Energy Efficiency Fund Page, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CT12R&re=1&ee=1, accessed June 4, 2014.
[6] Percentages reflect EE and Load Management Program costs from EIA data.
[7] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2014.

disabled family members, seniors, or young children. Funds go toward heating costs, with between $350 and $575 spent in each household helped.[8]

The LIHEAP Clearinghouse also compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data for Connecticut, from 2012, lists a total of $20.8 million in ratepayer funds dedicated toward low-income rate assistance, and $19.1 million in ratepayer funds dedicated toward low-income energy efficiency.[9]

As mentioned above, CEEF is funded in part through a charge levied on Connecticut Light and Power and United Illuminating customers. One energy efficiency program funded through CEEF is the Home Energy Solutions Income Eligible (HSE-IE) which addresses energy-efficient issues such as water heating, refrigeration and insufficient insulation. In addition, proceeds from surcharges on Connecticut Light and Power and United Illuminating customers can be used for arrearage forgiveness. The Matching Payment Program (MPP) is a mandated arrearage forgiveness program for eligible low-income customers. Both the HSE-IE and MPP are administered by the utilities with oversight from the Authority. Funding from electric utilities in 2012 was $12.8 million for arrears management and $14.8 million for energy efficiency.[10]

In addition to ratepayer-funded low-income programs, several charitable programs exist to provide rate assistance to low-income utility customers. A few examples of such programs are below:

- State legislation requires that all gas and electric utilities with over 75,000 customers facilitate customer donation to Operation Fuel, which provides help paying energy bills to low-income customers not eligible for other rate assistance programs.
- In Westport and Weston, community donations to the Warm Up Fund provide funds for fuel assistance.
- Donations to the Windsor Community Service Counsel go toward the Windsor Fuel Bank, which provides fuel assistance for low-income customers not eligible for other rate assistance programs.[11]

[8] LIHEAP Clearinghouse State Profile, available at http://liheap.ncat.org/profiles/Connecticut.htm, accessed June 4, 2014.
[9] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 4, 2014.
[10] LIHEAP Clearinghouse Connecticut Snapshot, available at http://liheap.ncat.org/dereg/states/ctsnapshot.htm, accessed June 4, 2014.
[11] LIHEAP Clearinghouse Connecticut Profile, available at http://liheap.ncat.org/profiles/Connecticut.htm, accessed June 4, 2014.

FLORIDA

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
- **Collection of energy efficiency (and other) revenues**
  - The Commission oversees the collection and spending of funds collected by utilities for energy efficiency, RD&D, and low-income programs
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 66% residential, 24% commercial, and 10% industrial
- **Protection of low-income customers**
  - Programs resulting from state-mandated FEECA provide energy efficiency savings to low-income customers
  - Charitable rate assistance programs are also available
  - LIHEAP funding in 2014: $77,350,999

State ratemaking practices:

Florida law mentions the importance of addressing equity and fairness in ratemaking. In particular, Florida Statute Title XXVII, §366.03 states that "All rates and charges made, demanded, or received by any public utility for any service rendered, or to be rendered by it, and each rule and regulation of such public utility, shall be fair and reasonable." The Florida Public Service Commission accomplishes the goal of "fixing fair, just, and reasonable rates for each customer class" by "consider[ing] the cost of providing service to the class, as well as the rate history, value of service, and experience of the public utility; the consumption and load characteristics of the various classes of customers; and public acceptance of rate structures."[1]

Collection of energy efficiency (and other) revenues:

The Florida Energy Efficiency and Conservation Act (FEECA) requires that utilities offer energy efficiency, R&D, and low-income programs, which are funded through a charge on customers' utility bills. Programs resulting from this act are administered by the utilities, and the Public Service Commission provides oversight.[2]

[1] Florida Statute Title XXVII, §366.03 and §366.06, 2010 Florida Statutes.
[2] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010; Florida Energy Efficiency Goals webpage, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=FL25R&re=1&ee=1, accessed June 4, 2014.

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Florida in 2012 was distributed in the following way: 66% of spending was on residential customers, 24% was on commercial customers, and 10% was on industrial customers.[3] This is in rough proportion to the electric revenues collected from each rate class.[4]

Low-Income Programs:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Florida, funding for 2014 totaled $77,350,999. Customers whose income is not greater than 150% of the Federal Poverty Level are LIHEAP-eligible. LIHEAP funds go toward both heating and cooling, and between $150 and $300 is spent per household.[5]

As mentioned above, FEECA requires that utilities of a certain size meet certain goals relating to energy efficiency, among other things. All five of the state's investor owned utilities (IOUs) and two municipal utilities are subject to this law, and below is an example of one company's implementation.[6]

- Tampa Electric is one of the IOUs that falls under FEECA. Tampa Electric has a Neighborhood Weatherization program, where free energy-savings kits are distributed. Tampa Electric partners with non-profit Tampa Hillsborough Action Plan (THAP) for this program.[7]

Outside of FEECA, other IOUs and municipal utilities offer their own energy efficiency and rate assistance programs. For example, City of Tallahassee Utilities has a Good Neighbor Program where they offer a 25% credit on electric service for qualified customers when funds are available. This program additionally provides weatherization and energy efficiency measures.[8]

Many utilities also offer charitable programs to help with energy assistance. Examples include:

- Some programs, such as the City of Lake Worth Utilities' Share to Care Program, are funded through customer donations and are used to help needy families pay their energy bills. Share to Care is administered by the Salvation Army.
- Other programs, like Fort Pierce Authority's Project Care, are funded by business and religious and civic organizations, in addition to individuals.[9]

[3] Percentages reflect EE and Load Management Program costs from EIA data.
[4] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2014.
[5] LIHEAP Clearinghouse State Profile, available at http://liheap.ncat.org/profiles/Florida.htm, accessed June 4, 2014.
[6] Florida Energy Efficiency Goals webpage, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=FL25R&re=1&ee=1, accessed June 4, 2014.
[7] LIHEAP Clearinghouse Florida Profile, available at http://liheap.ncat.org/profiles/Florida.htm, accessed June 4, 2014.
[8] LIHEAP Clearinghouse Florida Profile, available at http://liheap.ncat.org/profiles/Florida.htm, accessed June 4, 2014.
[9] LIHEAP Clearinghouse Florida Profile, available at http://liheap.ncat.org/profiles/Florida.htm, accessed June 4, 2014.

GEORGIA

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
  - Low-income considerations
- **Disbursement of energy efficiency revenues**
  - Energy efficiency spending in 2012 was 56% residential, 24% commercial, and 21% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $11.4 million toward rate assistance and $1.75 million toward energy efficiency in 2011
  - Senior citizen discount rates for qualifying customers over 65
  - Weatherization services distributed by the Georgia Environmental Finance Authority
  - HEAT and SHARE programs help customers with energy assistance
  - LIHEAP funding in 2014: $61,157,824

State ratemaking practices:

Georgia has laws and practices in place to protect its utility customers. In Georgia State Code §46-2-20c, the law states that the Commission "may, either by general rules or by special orders in particular cases, require all companies under its supervision to establish and maintain such public services and facilities as may be reasonable and just."[1] This is supported in a recent rate case, where the Commission writes that, in general, "a Settlement Agreement must be considered as a whole, and examined as to whether its adoption serves the public interest by resulting in just and reasonable rates for all classes of ratepayers." Further, in reviewing the cost of service study provided as part of a recent rate case and in listening to the opinions of interested parties, the Commission found that "that the allocation of costs and rate design contemplated in the Settlement Agreement are reasonable and in the best interests of all customer groups."[2]

In addition to ensuring equity across customer classes, the Commission also considers the rate-paying abilities of low-income customers. In the aforementioned rate case, for example, the Commission ordered that the low-income senior discount "be increased by an amount sufficient to offset the impact of the rate increases specified in the Settlement Agreement" to protect this class of customers.[3]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Georgia in 2012 was distributed in the following way: 56% of spending was on residential customers, 24% was on commercial customers, and 21% was on industrial customers.[4] This is in rough proportion to the electric revenues collected from each rate class.[5]

[1] Georgia State Code §46-2-20c.
[2] Georgia Rate Case Docket 36989, Order Issued November 18, 2013.
[3] Georgia Rate Case Docket 36989, Order Issued November 18, 2013.
[4] Percentages reflect EE and Load Management Program costs from EIA data.

Low-income programs:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Georgia, funding for 2014 totaled $61,157,824. Customers whose income is not greater than 60% of the state median income are LIHEAP-eligible. An estimated 156,649 households benefited from LIHEAP heating and cooling assistance in 2013. The average among spent on heating for LIHEAP customers in 2013 was $345, and customers received a maximum of $350 for cooling.[6]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2011 lists a total of $11.4 million in ratepayer funds dedicated toward low-income rate assistance, and $1.75 million in ratepayer funds dedicated toward low-income energy efficiency.[7] These numbers include totals from state- and utility-administered programs.

Since 1989, the Georgia Commission has also required that all major utilities waive their monthly service charge for qualifying low-income customers over the age of 65.[8] For example, qualifying customers of Georgia Power and Savannah Electric are eligible to receive a $14.00 discount on their electric bills. Funding in 2011 for this program totaled $16 million across electric and gas utilities.[9]

In addition, many charitable rate assistance and energy efficiency programs exist throughout the state. These programs are offered both through state agencies and through individual utilities. Examples of these programs are below:

- The Georgia Department of Human Resources also administers the statewide Heating Energy Assistance Team (HEAT) program, which uses funds from private citizens and the natural gas industry to help customers with energy assistance.[10]
- The Georgia Environmental Finance Authority also distributes funds for weatherization assistance through Community Action Agencies.[11]

In addition, most electric and gas utilities give customers the opportunity to make charitable donations through their electric bills. This program, Project SHARE, is administered by the Salvation Army.[12] Some utilities, like Georgia Power Company and Atlanta Gas Light Company, also match the donations of their customers. This money then goes toward energy assistance for low-income customers.[13]

[5] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2014.
[6] LIHEAP Clearinghouse Georgia State Profile, available at http://liheap.ncat.org/profiles/Georgia.htm, accessed June 4, 2014.
[7] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 4, 2014.
[8] LIHEAP Clearinghouse Georgia State Profile, available at http://liheap.ncat.org/profiles/Georgia.htm, accessed June 4, 2014.
[9] LIHEAP Clearinghouse Georgia State Snapshot, available at http://liheap.ncat.org/dereg/states/gasnapshot.htm, accessed June 4, 2014.
[10] LIHEAP Clearinghouse Georgia State Profile, available at http://liheap.ncat.org/profiles/Georgia.htm, accessed June 4, 2014.
[11] Georgia Public Service Commission, Consumer Advisory, available at http://www.psc.state.ga.us/consumer_corner/cc_advisory/payassist.asp, accessed June 4, 2014.
[12] LIHEAP Clearinghouse Georgia State Profile, available at http://liheap.ncat.org/profiles/Georgia.htm, accessed June 4, 2014.
[13] Georgia Public Service Commission, Consumer Advisory, available at http://www.psc.state.ga.us/consumer_corner/cc_advisory/payassist.asp, accessed June 4, 2014.

ILLINOIS

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Department of Commerce and Economic Opportunity has overseen the collection and spending of public benefit funding mechanisms for 17 years
  - Public benefit funding for energy efficiency is collected from utilities using a pro rata share of $3 million
  - Public benefit funding for renewables is collected from all rate classes, and all customers within rate classes, as a set fee that varies by rate class
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues from residential customers are spent in rough proportion to the dollars collected within that rate class
  - Energy efficiency spending in 2012 was 50% residential, 48% commercial, and 2% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $58.9 million toward rate assistance and $13.7 million toward energy efficiency in 2012
  - State-mandated SLEAF provides funds to help with bill assistance and weatherization
  - Utility-specific arrears management and energy efficiency components
  - LIHEAP funding in 2014: $167,457,747

State ratemaking practices:

Illinois Statute 220 ILCS 5/1-102 mandates equitable utility service stating "The General Assembly finds that the health, welfare and prosperity of all Illinois citizens require the provision of adequate, efficient, reliable, environmentally safe and least-cost public utility services at prices which accurately reflect the long-term cost of such services and which are equitable to all citizens." Part of determining equitable pricing is determining how rates should vary across different customer classes, and the law further clarifies that "variation in costs by customer class and time of use is taken into consideration in authorizing rates for each class."[1]

When a utility seeks to change its rates, the Illinois Commerce Commission hears a rate case, which is when the above laws are enforced. In one recent rate case, the Commission evaluated Commonwealth Edison Company's Embedded Cost of Service Study and found that it "reasonably allocates costs among customer classes and is approved."[2]

[1] Statute 220 ILCS 5/1-102, effective June 30, 2001.
[2] Illinois Rate Case Docket 13-0318, Order Issued December 18, 2013.

Collection of energy efficiency (and other) public benefit revenues:

In 1997, Illinois established non-bypassable public benefits funds for energy efficiency, renewable energy, and low-income assistance programs. The funds are administered and overseen by the Department of Commerce and Economic Opportunity (DCEO).[3]

The restructuring legislation of 1997 created separate funds for energy efficiency and renewable energy. Money for the Energy Efficiency Trust Fund (Trust) comes from electric utilities and alternative retail electric supplier contributions on a pro-rata basis based on the amount of energy sold. In addition to receiving funds from electric utilities, the Trust may receive contributions resulting from the Energy Efficiency Portfolio Standard (EEPS). From 1998-2015, contributions to the Trust are expected to total $54 million. The EEPS fund stood at $95 million for 2012. The total yearly contribution of all utilities to the Trust is $3 million.[4]

In addition to creating the Trust, the 1997 legislation created the Renewable Energy Resources Trust Fund (RERTF). This fund supports renewable energy through grants, loans, and other incentives, and is funded by a mandatory surcharge on IOUs' customers' electric and gas bills, that varies based on customer class. Municipal utilities and electric cooperatives also have the option of participating. Half of the proceeds collected fund the RERTF, while the other half fund the Coal Technology Development Assistance Fund. The RERTF generally receives between $5 million and $5.5 million annually, and surcharges on electric customers vary by rate class in the following way: $0.05/month for residential customers, $0.50/month for nonresidential customers with less than 10 MW peak demand during the previous year, and $37.50/month for nonresidential electric service with at least 10 MW of peak demand during the previous year.[5]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Illinois in 2012 was distributed in the following way: 50% of spending was on residential customers, 48% was on commercial customers, and 2% was on industrial customers.[6] Energy efficiency spending on residential customers is in rough proportion to the electric revenues collected from that rate class.[7]

Low-income programs:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Illinois, funding for 2014 totaled $167,457,747. Customers whose income is not greater than 150% of the Federal Poverty Level are LIHEAP-eligible, and receive up to $100 for heating.[8]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists a total of $58.9 million in ratepayer funds dedicated toward low-income rate assistance, and

[3] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[4] Energy Efficiency Public Benefits Fund, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL10R&re=1&ee=1, accessed June 4, 2014.
[5] Renewable Energy Resources Trust Fund, DSIRE database, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL01R&re=1&ee=1, accessed June 4, 2014.
[6] Percentages reflect EE and Load Management Program costs from EIA data.
[7] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2014.
[8] LIHEAP Clearinghouse Illinois Profile, available at http://liheap.ncat.org/profiles/Illinois.htm, accessed June 4, 2014.

$13.7 million in ratepayer funds dedicated toward low-income energy efficiency.[9] These numbers include totals from state- and utility-administered programs.

Utility restructuring created the Supplemental Low-Income Energy Assistance Fund (SLEAF). Gas and electric utilities deposit a monthly surcharge from customers into the fund. This money, along with federal LIHEAP funds, gets distributed to low-income customers to help with bill payment assistance and weatherization. Money spent from the fund totals around $76 million annually. SLEAF funds are spent only on customers whose utilities contribute to the fund.[10]

In addition to rate assistance programs stemming from SLEAF, utilities offer low-income arrearage management and energy efficiency components. Below is a summary of ratepayer funded low-income programs offered by Ameren Illinois, ComEd, Nicor Gas, and Peoples Gas/North Shore Gas:[11]

- The Percentage of Income Payment Plan (PIPP) is open to customers whose income is at or below 150% of the Federal Poverty Level. Participants pay no more than 6% of their income on their utilities bill, and participants who make PIPP payments on time receive a credit of 1/12th of overdue bills and can receive up to $1,000 annually for past due statements. PIPP is funded by a flat fee on customers' bills that varies based on customer classes, and is overseen by the DCEO.
- The DCEO also oversees federal Weatherization Assistance Programs, which are supplemented by ratepayer funds from the above utilities.

ComEd offers a Residential Special Hardship, where customers who are experiencing hardship such as job loss or illness and making less than 250% of the Federal Poverty Level are eligible to receive up to $500 on a biannual basis to deal with that hardship.[12]

[9] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 4, 2014.
[10] LIHEAP Clearinghouse Illinois Profile, available at http://liheap.ncat.org/profiles/Illinois.htm, accessed June 4, 2014.
[11] LIHEAP Clearinghouse State Snapshot, available at http://liheap.ncat.org/dereg/states/ilsnapshot.htm, accessed June 4, 2014.
[12] LIHEAP Clearinghouse State Snapshot, available at http://liheap.ncat.org/dereg/states/ilsnapshot.htm, accessed June 4, 2014.

MAINE

Summary

- **State ratemaking practices**
  - Just and reasonable allocation of utility costs to rate classes
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Commission has overseen the collection and spending of public benefit funding mechanisms for 17 years
  - Public benefit funding is collected from consumers on a voluntary basis and from utilities through both alternative compliance payments and charges collected on a volumetric basis
- **Disbursement of energy efficiency (and other) public benefit revenues**
  - Energy efficiency spending in 2012 was 35% residential, 43% commercial, and 21% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $8.3 million toward rate assistance and $930,000 toward energy efficiency in 2011
  - Low income rates: ratepayer- and utility-funded programs offer low-income discounts on utility bills
  - Minimum levels of energy efficiency spending on low income customers: a minimum of 20% of Maine Efficiency Trust funds must go toward energy programs for low-income customers and another minimum of 20% must go toward energy programs for small business customers.
  - Charitable emergency assistance for heat, electricity, and other items is offered to communities in crisis
  - LIHEAP funding in 2013: $39,195,339

State ratemaking practices:

The state of Maine works toward just and reasonable allocation of utility costs to rate classes. Enacted in 1987, the Maine Title 35-A, Part 1, Chapter 3 states, "The rate, toll or charge, or any joint rate made, exacted, demanded or collected by any public utility for production, transmission, delivery or furnishing of electricity, gas, heat or water; for communications service; or for transportation of persons or property within this State or for any service rendered or to be rendered in connection with any public utility, shall be just and reasonable."[1] In addition to mandating low-income assistance in the form of funds collected through system benefit charges, which will be described in more detail below, the "Needs-Based Low-Income Assistance" section of the Maine Title states that no low-income assistance should be prohibited: "Nothing in this section may be construed to prohibit a transmission and distribution utility from offering

[1] Maine Title 35-A, Part 1: Public Utilities Commission Heading, Chapter 3: Rates of Public Utilities Heading, 1987, §301.2.

any special rate or program for low-income customers that is not in effect as of the effective date of this chapter, subject to the approval of the commission."[2]

Collection of energy efficiency (and other) public benefit revenues:

Maine established its first Public Benefit Fund, known as the Renewable Resource Fund (Fund), in 1997. The development and implementation of the Fund's energy efficiency programs was originally divided amongst three entities – the State Planning Office (SPO), the state's electric utilities, and the Maine Public Utilities Commission (PUC).[3] However, legislative amendments directed full administration to the PUC in 2002.[4]

Renewable energy programs are supported by revenues generated through both utilities customers and the utilities themselves. Utility customers generate revenue for the Fund through voluntary contributions on top of their monthly utilities bill. Additionally, public benefit revenues are also generated from utilities through any alternative compliance payments (ACP) made to comply with the state's renewable portfolio standard.[5] Collections through these voluntary utility customer contributions and utility ACPs generated approximately $800,000 in 2009, an estimated $1.325 million during 2010 and approximately $800,000 in 2011.[6]

In 2009, Maine established a larger fund under Public Law 372, known as the Efficiency Maine Trust (Trust). The Trust has no expiration date and collects funds for all of Maine's energy efficiency and renewable energy programs.[7] By statute, the Trust must direct at least 20% of the funds to energy programs for low-income residents and at least another 20% towards energy programs for small business customers. A large source of the Trust's funds for energy efficiency programs result from PUC assessments of 0.145 cents per kilowatt-hour from utilities. Revenue from utility assessments accounted for approximately $12.4 million in 2010, $12.9 million in 2011, and $13.2 million in 2012. The Trust also manages funds received from RGGI auctions and miscellaneous grants. In 2012, an approximate total of $34 million was collected from all sources to support Maine's energy efficiency and renewable energy programs.[8, 9]

Disbursement of energy efficiency (and other) public benefit revenues:

According to the EIA, energy efficiency spending in Maine in 2012 was distributed in the following way: 35% of spending was on residential customers, 43% was on commercial customers, and 21% was on industrial customers.[10]

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[2] Maine Title 35-A, Part 1: Public Utilities Commission Heading, Chapter 3: Rates of Public Utilities Heading, 1987, §3214.3.
[3] Maine Public Benefits Fund Page, DSIRE database, "Efficiency Maine Trust – Renewable Resource Fund," available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=ME07R&re=1&ee=1, accessed June 3, 2014.
[4] Maine Public Benefits Fund Page, DSIRE database, "Efficiency Maine Trust," available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=ME11R&re=1&ee=1, accessed June 3, 2014.
[5] Public Law 403 established the Renewable Portfolio Standard alternative compliance payment in 2007.
[6] Maine Public Benefits Fund Page, DSIRE database, "Efficiency Maine Trust – Renewable Resource Fund," available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=ME07R&re=1&ee=1.
[7] As of July 1, 2010, all of the funds in the Renewable Energy Fund were transferred to the Efficiency Maine Trust.
[8] Maine Public Benefits Fund Page, DSIRE database, "Efficiency Maine Trust," available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=ME11R&re=1&ee=1, accessed June 3, 2014.
[9] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[10] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. Maine LIHEAP funding is currently set at $39,195,339 for 2014. To be LIHEAP-eligible, utility customers must have a household income of no greater than 60% the state median income. Additionally, Maine offers LIHEAP eligibility to households with incomes between 150% and 170% of the federal poverty guidelines if a member is susceptible to hypothermia (e.g. elderly or children under the age of two) or with the guidance of a doctor's note. In 2013, an estimated 44,556 households benefited from LIHEAP heat assistance. These households received an average LHIHEAP heating benefit of $556, a minimum benefit of $144, and a maximum benefit of $1,656.[11]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency program by state, where applicable. The most recent Maine data from 2011 lists a total of $8.3 million in ratepayer funds dedicated toward low-income rate assistance, and $930,000 in ratepayer funds dedicated toward low-income energy efficiency programs. These numbers include totals from state- and utility-administered programs.[12] Participating utilities include Central Maine Power Company and Emera Maine,[13] which cover 95% of the state, as well as 10 consumer-owned utilities.

Maine has several low-income rate assistance and energy efficiency programs that are administered by utilities with regulatory oversight. The ratepayer funded programs, their funding mechanisms and administration, are listed below:

- The Low Income Assistance Program (LIAP) offers rate assistance benefits that vary by utility, but are most often a credit to or discount on an electric bill. To be eligible for LIAP, individuals must be LIHEAP-eligible customers of participating electric utilities and not reside in subsidized housing.
    - *Funding mechanism:* funds for LIAP are generated by a customer charge based on 0.5% of a utility's annual revenue. Funding for LIAP totaled $8.3 million in 2012.
    - *Administration:* LIAP is administered by the Maine State Housing Authority, in coordination with local delivery agencies.
- The Low-Income Weatherization energy efficiency program offers appliance replacement and updates to building envelop and heating systems for single and multi-family dwellings.
    - *Funding mechanism:* funds for the Low-Income Weatherization program stem from the system benefit charge. Funding for the program totaled $930,311 in 2012.
    - *Administration:* the Low-Income Weatherization program is administered by the Efficiency Maine Trust.[14]

[11] LIHEAP Clearinghouse Maine Profile, available at http://liheap.ncat.org/profiles/Maine.htm, accessed June 3, 2014.
[12] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 3, 2014.
[13] Emera Maine is the corporate parent to once separate utilities, Bangor Hydro-Electric Company and Maine Public Service Co.
[14] LIHEAP Maine State Snapshot, available at http://liheap.ncat.org/dereg/states/mesnapshot.htm, accessed June 3, 2014.

In addition to the ratepayer funded programs listed above, utilities also offer rate assistance and energy efficiency programs to low-income customers. Examples of each include, but are not limited to, the following:[15]

Low-Income Rate Assistance:

- Central Maine Power's Electricity Lifeline Program offers qualified low-income customers a credit on their electric bill. This credit is based on household income and estimated electricity usage and is applied to your bill for the same amount each month, up to 12 months.
- Unitil's Discount Rate Program offers LIHEAP recipients a 30% discount on gas that is effective for a 12 month period.

Low-Income Energy Efficiency:

- Maine's Low Income Refrigerator Replacement program replaces inefficient refrigerators and installs energy efficient lighting for qualifying low-income consumers.[16] This program is made possible by the collaborative efforts of Efficiency Maine, the Maine State Housing Authorities and Community Action Programs throughout the state.
- Unitil offers no-cost home energy assessments and installation of weatherization measures to qualifying households.

In addition to the ratepayer- and utility-based programs listed above, the state also has charitable assistance in the event of crises. For example, Maine Sea Coast Mission offers "emergency assistance for heat, electricity, food and other emergency circumstances for island and coastal communities from mid- to Downeast coastal Maine."[17]

[15] LIHEAP Clearinghouse Maine Profile, available at http://liheap.ncat.org/profiles/Maine.htm, accessed June 3, 2014.
[16] All LIHEAP applicants are automatically considered for the Appliance replacement program.
[17] LIHEAP Clearinghouse Maine Profile, available at http://liheap.ncat.org/profiles/Maine.htm, accessed June 3, 2014.

MARYLAND

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Public Service Commission has overseen the collection of universal service funds used to help low-income utility customers for 15 years
  - Universal service program funding is collected from all rate classes, and all customers within rate classes, on a volumetric basis
- **Disbursement of energy efficiency revenues**
  - Energy efficiency spending in 2012 was 71% residential and 29% commercial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $37 million toward rate assistance and $15 million toward energy efficiency in 2012
  - State-mandated programs providing low-income rate assistance, arrearage management, and energy efficiency programs as a result of 1999 restructuring
  - Utility-funded rate assistance and weatherization programs exist
  - Charitable rate assistance and weatherization programs also exist
  - LIHEAP funding in 2014: $68,513,491

State ratemaking practices:

In a recent rate case in which Baltimore Gas and Electric (BGE) requested adjustments to its base rates, BGE filed two cost of service studies (COSSs) to "determine the costs a customer class, or in some cases a jurisdiction, imposes upon a company." The results of the COSSs were then used by the Public Service Commission (Commission) "as a guide in developing appropriate customer class rates." Based upon this COSS, the Commission determined "that BGE has appropriately allocated its electric and gas plant . . . because the Studies fairly and reasonably distribute costs among its customer classes and are consistent with previous Company COSSs approved by the Commission."[1] In this way, the State of Maryland ensures through its Commission that rates are reasonably assigned to different customer classes based on cost.

Collection of energy efficiency (and other) public benefit revenues:

In 1999, the Maryland state legislature created a public benefit fund for low-income assistance and energy efficiency as a part of utility restructuring. The Maryland Public Service Commission serves as the oversight body. [2] Initially, the restructuring law provided $34 million for low-income programs, and was

[1] Public Service Commission Rate Case 9326, Order no. 86060, Issued December 13, 2013.
[2] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.

increased to $37 million in 2005-2006. The majority of funding—74%—comes from industrial and commercial customers, while 26% comes from residential customers.[3]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Maryland in 2012 was distributed in the following way: 71% of spending was on residential customers and 29% was on commercial customers.[4]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Maryland, funding for 2014 totaled $68,513,491. Customers whose income is not greater than 175% of the Federal Poverty Level are LIHEAP-eligible. An estimated 113,787 households benefited from LIHEAP heat assistance in 2013 and received an average of $496 in heating assistance.[5]

One LIHEAP-affiliated Maryland program is the Universal Service Protection Program, which subtracts the LIHEAP benefit from customers' bills and divides the remainder by twelve months in order to even out monthly utility payments.[6]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists a total of $37 million in ratepayer funds dedicated toward low-income rate assistance, and $15 million in ratepayer funds dedicated toward low-income energy efficiency.[7] These numbers include totals from state- and utility-administered programs.

The Electric Universal Service Program was authorized during utility restructuring in 1999 and includes bill assistance, arrears management, and weatherization services.[8] As mentioned above, the EUSP is funded by surcharges on all customer classes. Eligible low-income customers receive discounts of 17% to 35% of their bill, with an average benefit of $334. Arrearage retirement programs also exist, where customers at least $300 in arrears and can receive a maximum benefit of $2,000 once every seven years. These programs are administered by the Office of Home Energy Programs in the Department of Human Resources.[9]

EmPower Maryland Low Income Energy Efficiency Programs (LIEEP) is administered by the Maryland Department of Housing and Community Development and is available to customers of BGE, Southern Maryland Electric Cooperative, Delmarva Power, Potomac Edison, and Potomac Electric Power Company. This program is funded by a surcharge on all customer classes and provides weatherization

[3] LIHEAP Clearinghouse Maryland PBF Overview, available at http://www.liheap.ncat.org/dereg/states/maryland.htm, accessed June 4, 2014.
[4] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2014. Percentages reflect EE and Load Management Program costs from EIA data.
[5] LIHEAP Clearinghouse Maryland Profile, available at http://liheap.ncat.org/profiles/Maryland.htm, accessed June 4, 2014.
[6] LIHEAP Clearinghouse Maryland Profile, available at http://liheap.ncat.org/profiles/Maryland.htm, accessed June 4, 2014.
[7] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 4, 2014.
[8] LIHEAP Clearinghouse Maryland Profile, available at http://liheap.ncat.org/profiles/Maryland.htm, accessed June 4, 2014.
[9] LIHEAP Clearinghouse Maryland State Snapshot, available at http://liheap.ncat.org/dereg/states/mdsnapshot.htm, accessed June 4, 2014.

services such as attic, floor, and wall installation and lighting retrofits. LIEEP funding in 2012 totaled $15 million.[10]

In addition to the above programs, many utilities offer additional rate assistance and energy efficiency programs. A few examples are below:[11]

- BGE, along with many smaller utilities, offers deposit, reconnect fee, and application fee waivers to qualifying low-income customers.
- PEPCO offers a Residential Aid Discount Program which provides eligible customers that do not have all-electric heating with a 63% discount on the first 400 kwh of energy usage in the summer and a 32% discount in the winter. Discounts for customers with all-electric heating are 38% on the first 700 kwh of energy used in the summer and a 51% discount in the winter.
- BGE and Colombia bas both offer free weatherization programs for qualifying low-income customers.

Lastly, many charitable energy assistance programs exist to help low-income customers. For example, the Fuel Fund of Maryland, Inc. consists of fuel funds from several counties and provides help for customers that use oil. The Victorine Q. Adams Fuel Fund similarly provides up to $125 for clients facing energy shut-offs, and also helps with arrears management and emergency energy situations. Other utilities offer matching programs from customer donations that go toward low-income rate assistance.[12]

[10] LIHEAP Clearinghouse Maryland State Snapshot, available at http://liheap.ncat.org/dereg/states/mdsnapshot.htm, accessed June 4, 2014.
[11] LIHEAP Clearinghouse Maryland Profile, available at http://liheap.ncat.org/profiles/Maryland.htm, accessed June 4, 2014.
[12] LIHEAP Clearinghouse Maryland Profile, available at http://liheap.ncat.org/profiles/Maryland.htm, accessed June 4, 2014.

MASSACHUSETTS

Summary

- **State ratemaking practices**
  - The DPU works to equitably allocate utility costs to rate classes
- **Collection of energy efficiency (and other) public benefit revenues**
  - The DPU along with the utilities and Massachusetts Clean Energy Center have overseen the collection and spending of public benefit funding mechanisms for 17 years
  - Public benefit funding is a non-bypassable charge and collected on a volumetric basis
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent roughly in proportion to the dollars collected from rate classes
  - Energy efficiency spending in 2012 was 49% residential, 32% commercial, and 18% industrial
- **Protection of low-income customers**
  - Low-income rates: there is a low-income discount on natural gas and electricity bills
  - Minimum energy efficiency spending: the low-income sector is allocated at least 10% of the funds for electric energy efficiency programs and 20% of the funds for gas energy efficiency programs
  - Ratepayer-funded low-income programs totaled $103.6 million toward rate assistance and $36.6 million toward energy efficiency in 2012
  - Massachusetts also has arrearage management and low-income demand side management programs
  - LIHEAP funding in 2014: $140,014,388

State ratemaking practices:

The Massachusetts Department of Public Utilities (DPU) works to equitably allocate utility costs to the different customer classes. In particular, Massachusetts state law requires that the DPU, "design base distribution rates using a cost-allocation method that is based on equalized rates of return for each customer class." [1] Furthermore, the DPU considers the impacts of their actions on low-income electricity customers. The law states, "In all decisions or actions regarding rate designs, the department shall consider the impacts of such actions, including the impact of new financial incentives on the successful development of energy efficiency and on-site generation. Where the scale of on-site generation would have an impact on affordability for low-income customers, a fully compensating adjustment shall be made to the low-income rate discount." Lastly, the department requires electric distribution companies to include a low-income customer discount. "The department shall require that distribution companies provide discounted rates for low income customers comparable to the low-income discount rate in effect prior to March 1, 1998."[2]

[1] The Commonwealth of Massachusetts, General Laws, Part I, Title XXII, Chapter 164, Section 94I.
[2] The Commonwealth of Massachusetts, General Laws, Part I, Title XXII, Chapter 164, Sections 1F and 141.

Collection of energy efficiency (and other) public benefit revenues:

As part of electric industry restructuring, Massachusetts established a public benefit fund in 1997 to fund renewable energy, energy efficiency, and low-income assistance programs. The charge is non-bypassable, and is administered by two entities. The renewable energy programs are administered by the Massachusetts Clean Energy Center, while the energy efficiency and low-income assistance programs are administered by the utilities.[3] DSIRE reports that the charge for renewables is 0.5 mill/kWh, while the energy efficiency and low-income assistance charge is 2.5 mills/kWh.[4]

The public benefit fund receives additional revenues from RGGI auction proceeds since Massachusetts is a participating state.[5]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Massachusetts in 2012 was distributed in the following way: 49% of spending was on residential customers, 32% was on commercial customers, and 18% was on industrial customers. This is roughly proportional to the electric revenues collected from each customer class.[6]

Protection of low-income customers:

LIHEAP provides states with federal funding to assist low-income utility customers with their home energy bills. For Massachusetts, funding for fiscal year 2014 totaled a little over $140 million. For 2013, this funding reached an estimated 190,432 households. In particular, LIHEAP benefits included a minimum of $450 for deliverable fuel, $260 for gas and electric, with a maximum of $750 and $430 for fuel, and gas and electric, respectively. Customers eligible for LIHEAP are those whose income is not greater than 60% of the state median income.[7]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists a total of $103.6 million in ratepayer funds dedicated toward low-income rate assistance, and $36.6 million in ratepayer funds dedicated toward low-income energy efficiency. These numbers include totals from state- and utility-administered programs.[8]

Massachusetts has several low-income rate assistance and energy efficiency programs that are administered by utilities with regulatory oversight. Participating utilities include a number of gas, electric and combination IOUs in Massachusetts. The utility rate discounts total nearly $40 million per year, and

[3] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[4] "Renewable Energy Trust Fund," Database of State Incentives for Renewables & Efficiency (DSIRE), Massachusetts Incentives/Policies for Renewables & Efficiency, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA07R&re=1&ee=1, accessed June 3, 2014.
[5] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[6] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.
[7] LIHEAP Clearinghouse Massachusetts Profile, available at http://liheap.ncat.org/profiles/Mass.htm, accessed June 3, 2014.
[8] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.

the discounts reduce the low-income customer's bill between 20% and 42%.[9] A selection of such low-income assistance programs are listed below:

- Utilities including National Grid, NStar, Unitil, Western Massachusetts Electric, Berkshire Gas, Columbia Gas, and New England Gas offer discount rates for low-income customers through a Residential Discount Rate.
    - Annual funding in 2012 for the low-income discount was $103 million and served 406,000 households.
- NSTAR offers a Forgiveness Program for those customers experiencing difficulty paying their utility bill. Those with an income that falls within 60% of the state median income are eligible to participate in the program.
- Arrearage Management Programs
    - NSTAR and Berkshire Gas have programs in place that provide financial assistant to qualifying low-income customers that have outstanding bills in arrears.
    - This program reached 12,632 electric and 4,692 gas households in 2012.

In addition to the above utility-administered low-income rate assistance programs, many who receive the low-income discount rate are also eligible for free energy efficiency services.[10] A few examples of utilities' programs are included below:

- Berkshire Gas' energy efficiency program will cover 100% of installed costs for energy-saving measures to low-income heating customers.
- Unitil provides eligible low-income customers with free energy efficiency services, including energy audits, electric baseload measures, appliance efficiency services, and heating system replacement.
- National Grid's free home weatherization program offers low-income customers free home weatherization from a license and insured local company, paid for my National Grid.

NSTAR's energy efficiency program provides customers who qualify for NSTAR's discount rate with a free home energy consultation. The consultation could include the installation of energy-saving measures.

[9] LIHEAP Massachusetts State Snapshot, available at http://liheap.ncat.org/dereg/states/masnapshot.htm, accessed June 3, 2014.
[10] LIHEAP Clearinghouse Massachusetts Profile, available at http://liheap.ncat.org/profiles/Mass.htm, accessed June 3, 2014.

MICHIGAN

Summary

- **State ratemaking practices**
  - The Michigan PSC works to equitably allocate utility costs to rate classes
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 49% residential, 43% commercial, and 8% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $23.7 million toward energy efficiency in 2012
  - There are a number of emergency charitable assistance programs in place
  - LIHEAP funding in 2014: $165,443,927

State ratemaking practices:

Michigan state law requires that the PSC consider all customer classes and set rates in a just and reasonable fashion. In particular, the Commission ensures "all persons in this state are afforded safe, reliable electric power at a reasonable rate." Furthermore, utilities must consider low-income and senior citizen customers when filing for changes in rates. The law states that "[u]pon filing of a rate increase request, a utility shall include proposed eligible low-income customer and eligible senior citizen customer rates and a method to allocate the revenue shortfall attributed to the implementation of those rates upon all customer classes."[1]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Michigan in 2012 was distributed in the following way: 49% of spending was on residential customers, 43% was on commercial customers, and 8% was on industrial customers. This is in rough proportion to the electric revenues collected from each rate class.[2]

Protection of low-income customers:

LIHEAP provides states with federal funding to assist low-income utility customers with their home energy bills. For Michigan, funding for fiscal year 2014 totaled $165 million. Customers whose income is 110% of the federal poverty guidelines qualify for LIHEAP heating assistance. Crisis assistance goes to customers whose income is 150% of the federal poverty guidelines. An estimated 623,549 households benefited from LIHEAP heat assistance in fiscal year 2013. As an example, LIHEAP benefits for fiscal year 2013 included a maximum of $850 for heating assistance.[3]

[1] Act 3 of 1939 - Add. 2000, Act 141 (effective June 5, 2000); Act 3 of 1939 - Add. 2008, Act 286 (effective October 6, 2008).
[2] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.
[3] LIHEAP Clearinghouse Michigan Profile, available at http://liheap.ncat.org/profiles/Michigan.htm, accessed June 11, 2014.

The LIHEAP Clearinghouse compiles a table that provides the breakdown of Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency by state for certain states. The most recent data from 2012 lists a total of $23.7 million in ratepayer funds dedicated toward low-income energy efficiency.[4] These numbers include totals from state- and utility-administered programs.

Michigan has several low-income assistance programs that are administered by utilities with regulatory oversight. All utilities, including IOUs, municipals, and co-ops, participate in low-income energy efficiency programs.[5]

- Detroit Edison has two rate assistance programs and one energy efficiency assistance program in place.
    - Under the Residential Income Assistance Credit program, low-income customers may qualify for a $6 per month credit on their electric, and/or a $10.50 per month credit on their natural gas accounts.
    - The Senior Citizen Electric Service Rate program provides seniors 62 and older with savings up to 32%.
    - Detroit Edison offers energy efficiency assistance through the EEA Home Performance Rebate Program (includes an audit of effective energy improvements for one's home), Test and Tune-up Program (provides cleaning and tune-up of natural gas furnace), and Energy Star Refrigerator Replacement Program

In addition to the above utility-administered programs, the state offers low-income rate assistance programs. A few examples are below:[6]

- The Department of Treasury makes payments to eligible customers through the Home Heating Credit.
- Michigan has a State Emergency Relief fund that provides payments for heating fuel, electricity, and home repairs among other services. Customers must submit an application for assistance.

There are also a number of emergency charitable assistance programs in Michigan that offer low-income assistance. A few examples are below:[7]

- Consumers Energy works with the Salvation Army to provide bill credits for low-income gas and electric customers under the PeopleCare program.
- Indiana Michigan Power provides eligible low-income customers with electric bill assistance through their Energy Share program.
- Lansing Board of Water & Light's Pennies for Power Program provides low-income families with utility shutoff protection.

The Heat and Warmth Fund is a non-profit organization that offers bill-payment assistance in addition to promoting energy conservation, weatherization and energy efficiency education.

[4] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.
[5] LIHEAP Michigan Snapshot, available at http://liheap.ncat.org/dereg/states/misnapshot.htm, accessed June 11, 2014.
[6] LIHEAP Clearinghouse Michigan Profile, available at http://liheap.ncat.org/profiles/Michigan.htm, accessed June 11, 2014.
[7] LIHEAP Clearinghouse Michigan Profile, available at http://liheap.ncat.org/profiles/Michigan.htm, accessed June 11, 2014.

MINNESOTA

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to all customers
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - Xcel Energy administers a renewable development fund supported by Xcel customers
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent roughly in proportion to the dollars collected from rate classes
  - Energy efficiency spending in 2012 was 35% residential, 42% commercial, and 23% industrial
- **Protection of low-income customers**
  - Low-income rates: Xcel must provide a 50% discount to low-income customers on the first 300 kwh consumed each month
  - Beginning in 2010, a utility or association that furnishes electric service must spend 0.2% of its gross operating revenue from residential customers in the state on low-income programs
  - Ratepayer-funded low-income programs totaled $16.85 million toward rate assistance and $6.25 million toward energy efficiency in 2012
  - Arrearage management programs are in place for Minnesota low-income customers
  - LIHEAP funding in 2014: $114,540,746

State ratemaking practices:

The Minnesota Public Utility Commission (Commission) works to allocate utility costs equitably to the various rate classes. Since 1974, Minnesota law has required that "[e]very rate made, demanded, or received by any public utility, or by any two or more public utilities jointly, shall be just and reasonable. Rates shall not be unreasonably preferential, unreasonably prejudicial, or discriminatory, but shall be sufficient, equitable, and consistent in application to a class of consumers."[1] Furthermore, laws require special consideration of low-income customers. In addition to mandating that utilities fund affordability programs for low-income ratepayers, the law requires that the Commission "must consider ability to pay as a factor in setting utility rates and may establish affordability programs for low-income residential ratepayers in order to ensure affordable, reliable, and continuous service to low-income utility customers."[2]

[1] Minnesota Statute § 216B.03.
[2] Minnesota Statute § 216B.16 Subd. 15.

Collection of energy efficiency (and other) public benefit revenues:

In 1999, Xcel Energy established the Renewable Development Fund to promote the "start up, expansion and attraction of renewable energy projects and companies in the Xcel Energy service area."[3] The fund is financed by Xcel Energy ratepayers, and revenues are generally split between new development projects for renewable energy and research and development. Expenditures from the fund must be approved by the Commission.[4]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Minnesota in 2012 was distributed in the following way: 35% of spending was on residential customers, 42% was on commercial customers, and 23% was on industrial customers. This is roughly proportional to the electric revenues collected from each customer class.[5]

Protection of low-income customers:

LIHEAP provides states with federal funding to assist low-income utility customers with their home energy bills. For Minnesota, funding for 2014 totaled $114.5 million. In 2013, this funding reached 147,636 households and included a minimum of $100 and maximum of $1,200 for heating assistance. Customers eligible for LIHEAP are those whose income is not greater than 60% of the state median income.[6]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency by state for certain states. The most recent data from 2012 lists a total of $16.85 million in ratepayer funds dedicated toward low-income rate assistance, and $6.25 million in ratepayer funds dedicated toward low-income energy efficiency.[7] These numbers include totals from state- and utility-administered programs.

Minnesota state law requires that the PUC ensure "each utility and association provides low-income programs…Beginning in 2010, a utility or association that furnishes electric service must spend 0.2 percent of its gross operating revenue from residential customers in the state on low-income programs."[8] Minnesota has several low-income rate assistance programs that are ratepayer funded.[9] Several of such programs are listed below:[10]

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[3] "Overview," Xcel Energy Renewable Energy Development Fund, available at https://www.xcelenergy.com/Environment/Renewable_Energy/Renewable_Energy_Grants/Renewable_Development_Fund, accessed June 4, 2014. See also, "Renewable Development Fund (RDF)," Database for State Incentives for Renewables & Efficiency (DSIRE), available at, accessed June 3, 2014.

[4] "Overview," Xcel Energy Renewable Energy Development Fund, available at https://www.xcelenergy.com/Environment/Renewable_Energy/Renewable_Energy_Grants/Renewable_Development_Fund, accessed June 4, 2014. See also, "Renewable Development Fund (RDF)," Database for State Incentives for Renewables & Efficiency (DSIRE), available at, accessed June 3, 2014.

[5] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.

[6] LIHEAP Clearinghouse Minnesota Profile, available at http://liheap.ncat.org/profiles/Minn.htm, accessed June 3, 2014.

[7] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.

[8] Minnesota Statute § 214B.241 Subd. 7.

[9] LIHEAP Minnesota Snapshot, available at http://liheap.ncat.org/dereg/states/mnsnapshot.htm, accessed June 3, 2014.

[10] LIHEAP Minnesota Snapshot, available at http://liheap.ncat.org/dereg/states/mnsnapshot.htm, accessed June 3, 2014.

- LIHEAP eligible customers qualify for up to 37% discounts based on usage and a reduced monthly service charge fee under the Customer Affordability of Resident Electricity (CARE) program. Annual funding in 2012 for CARE was $282,130 and reached 2,760 households.
- All natural IOUs in Minnesota must provide a Gas Affordability Program (GAP) under a law passed in 2007. It reduces natural gas payments to no less than 6% of eligible customer's income.
    - Annual funding in 2012 for GAP was $7.7 million and reached 32,502 households.
- Xcel's Low-Income Senior Discount offers an additional discount of 50% on monthly electric consumption, up to kwhs per billing period, for those low-income residential electric and gas customers who are 62 years of age or older.
- The PowerOn Program provides LIHEAP customers various benefits based on energy use, income, and amount of arrears. The program served nearly 15,000 households in 2012.

In addition to the PowerOn program listed above that includes arrears management, Minnesota also facilitates arrears management through the Gas Affordability Program.

Low-income customers, who may receive rate assistance through the ratepayer funded programs described previously, may also qualify for several energy efficiency programs.[11] A few examples are below:

- Both Great Plains Natural Gas and Minnesota Energy Resources offer low-income weatherization programs. This includes weatherization measures such as insulation, caulking, weather-stripping, and storm windows and doors.
- Otter Tail Power Company's House Therapy Program provides customers with high bill concerns and high energy use with an energy analysis. The analysis may include the installation of energy-saving insulation and weather-stripping.

Many utilities also offer emergency charitable assistance that is to provide last resort emergency funds for low-income customers.[12] A number of emergency charitable programs in Minnesota are listed below:

- Minnesota law established Reach Out for Warmth in 1992, aiming to provide people in need with emergency energy assistance and furnace repair. The program is administered by the Energy Program Unit of the Department of Economic Security along with local energy assistance agencies.
- Minnesota utilities fund the "last resort" HeatShare program that is administered by the Salvation Army. The program provides money to help pay for electricity bills along with natural gas, oil, propane, wood, and emergency furnace repairs.
- Agralite Electric, Benco Electric, and Kandiyohi Power Cooperatives use customer donations to provide funds for individuals and organizations in need through Operating Round Up.

[11] LIHEAP Clearinghouse Minnesota Profile, available at http://liheap.ncat.org/profiles/Minn.htm, accessed June 3, 2014.
[12] LIHEAP Clearinghouse Minnesota Profile, available at http://liheap.ncat.org/profiles/Minn.htm, accessed June 3, 2014.

MISSOURI

Summary

- **State ratemaking practices**
  - Inquiry into impact of utility rates on vulnerable citizens
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues from residential customers are spent in rough proportion to the dollars collected within that rate class
  - Energy efficiency spending in 2012 was 52% residential, 47% commercial, and 1% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $600,000 toward rate assistance and $4.3 million toward energy efficiency in 2012
  - Utilities offer rate assistance and energy efficiency programs
  - Charitable rate assistance programs offered through organizations, utilities, cities, and counties also exist
  - LIHEAP funding in 2014: $70,882,484

State ratemaking practices:

In 2012, the Missouri Public Service Commission (Commission) "ordered an inquiry into the impact higher utility rates will have on older or low-income citizens and established a docket to consider rate design changes and methods other states use to reduce the impact of higher utility rates on financially vulnerable citizens."[1] In this way, the Commission is looking after low-income customers when it comes to utility rates.

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Missouri in 2012 was distributed in the following way: 52% of spending was on residential customers, 47% was on commercial customers, and 1% was on industrial customers.[2]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Missouri, funding for 2014 totaled $70,882,484. Customers whose income is not greater than 135% of the Federal Poverty Level are LIHEAP-eligible. An estimated 145,279 households benefited from LIHEAP in 2013, and the maximum heating benefit was $450.[3]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from

[1] "PSC Orders Inquiry Into Impact of Higher Utility Rates on Missouri's Low-Income Citizens," Missouri Public Service Commission Press Release, August 9, 2012.
[2] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.
[3] LIHEAP Clearinghouse Missouri Profile, available at http://liheap.ncat.org/profiles/Missouri.htm, accessed June 4, 2014.

2012 lists a total of $600,000 in ratepayer funds dedicated toward low-income rate assistance, and $4.3 million in ratepayer funds dedicated toward low-income energy efficiency.[4] These numbers include totals from state- and utility-administered programs.

Many Missouri utilities offer rate assistance and energy efficiency programs. Several examples are provided below:[5]

- Ameren Missouri's Keeping Current Program provides credits to low-income customers who remain current with payments during the heating and/or cooling seasons. The Dollar More agencies help determine qualifying customers. Ameren also offers a $500 credit on utility bills to military families.
- Independence Power & Light offers qualified low-income elderly or disabled customers a 50% discount on their electric bill through their Independence Rate Assistance Program
- Ameren Missouri provides weatherization for its customers through Operation Winter Survival

Other charitable rate assistance programs exist and are listed below. These include programs run by charitable organizations, along with programs specific to certain cities, counties, or coops:[6]

- HeatShare provides rate assistance for elderly or disabled low-income customers, along with customers unable to pay bills due to unexpected events, such as a birth or death in the family. In addition, HeatShare may offer grants to repair energy related equipment.
- Boone County offers a Heat Energy and Light Program to provide one-time assistance to low-income families with young children, and also offers a Citizens Assisting Seniors and Handicapped which provides assistance to low-income seniors and people with disabilities.
- City Utilities of Springfield offers a community supported rate assistance program called Project Share.

[4] LIHEAP Clearinghouse Missouri Profile, available at http://liheap.ncat.org/profiles/Missouri.htm, accessed June 4, 2014.
[5] LIHEAP Clearinghouse Missouri Profile, available at http://liheap.ncat.org/profiles/Missouri.htm, accessed June 4, 2014.
[6] LIHEAP Clearinghouse Missouri Profile, available at http://liheap.ncat.org/profiles/Missouri.htm, accessed June 4, 2014.

MONTANA

Summary

- **State ratemaking practices**
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - The PSC has overseen the collection and spending of public benefit funding mechanisms for 18 years
  - Public benefit funding is collected through a 2.4% surcharge rate based on electric utilities' 1995 revenue
- **Disbursement of energy efficiency revenues**
  - Energy efficiency spending in 2012 was 41% residential and 59% commercial
- **Protection of low-income customers**
  - $5.64 million in ratepayer funds dedicated toward low-income rate assistance in 2012
  - $1.66 million in ratepayer funds dedicated toward low-income energy efficiency in 2012
  - Low income rates: ratepayer- and utility-funded programs offer low-income discounts on utility bills
  - Charitable emergency assistance offered to communities in crisis
  - LIHEAP funding in 2014: $23,654,004

State Ratemaking Practices:

Montana includes low-income considerations in its ratemaking practices. For example, as ordered in 2011, the Department of Public Service Regulation Rate Case states, "As noted in Finding of Fact No. 211, MDU is not ordered to rebate the difference between the rates approved in the Interim Order and this Final Order. Rather, MDU must remit $5,000 to the state Department of Revenue for deposit in the low-income energy assistance fund administered by the state Department of Health and Human Services to be used for the benefit of customers in MDU's electric service territory."[1]

Collection of energy efficiency (and other) public benefit revenues:

Montana established its first public benefit fund in 1996. Called the Universal System Benefits Program (USBP), all electric utilities (including cooperatives) are required by law to charge customers a non-bypassable surcharge on electricity use. The fund is fully administered by the individual utilities and overseen by the Public Service Commission. Revenues generated by the USBP are directed towards research and development efforts and energy efficiency, conservation, renewable energy, and low-income energy assistance programs. Utilities may use a portion of USBP revenues to fund internal or eligible external programs. Large-scale utilities customers with loads exceeding one megawatt may also use a portion of the USBP-generated revenues for eligible internal programs. In 2011, the USBP generated approximately $9.4 million in revenue.

[1] Department of Public Service Regulation Rate Case - D2010.8.82 (Final Order Issued May 9, 2011).

The USBP was originally set to expire on December 31, 2009, but that expiration date has since been extended indefinitely.[2, 3]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Montana in 2012 was distributed in the following way: 41% of spending was on residential customers and 59% was on commercial customers.[4]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. Montana LIHEAP funding is currently set at $23,654,004 for 2014. To be LIHEAP-eligible, utility customers must have a household income of no greater than 60% the state median income. Additionally, a household of seven or more members may be LIHEAP-eligible if their income is no more than 150% of the federal poverty level. In 2013, an estimated 21,700 households benefited from LIHEAP heat assistance. These households received an average heating benefit of $541, a minimum benefit of $50, and a maximum benefit of $1,500.[5]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency by state for certain states. The most recent Montana data from 2012 lists a total of $5.64 million in ratepayer funds dedicated toward low-income rate assistance, and $1.66 million in ratepayer funds dedicated toward low-income energy efficiency. These numbers include totals from state- and utility-administered programs.[6] Participating utilities include NorthWestern Energy, Montana-Dakota Utilities, Energy West, and 24 rural electric cooperatives.

Montana has several low-income rate assistance and energy efficiency programs that are administered by utilities with regulatory oversight. The ratepayer funded programs, their funding mechanisms and administration, are outlined below:

- The Low Income Discounts program offers a 25% electric bill discount for the months of November through April to LIHEAP-eligible customers of NorthWestern Energy. Other utilities, which include cooperatives, offer discounted electric bills and rate assistance to low-income customers as well.[7]
    - *Funding Mechanism:* Funding for the program is generated from the USBP charge imposed on all electric and natural gas IOU ratepayers and rural electric cooperatives.
    - *Administration:* The Commission administers this program in coordination with LIHEAP and additional utilities.[8]
- The Free Weatherization Program (FWP) is offered to NorthWestern Energy customers who make no more than 200% of the federal poverty level. The LIHEAP Clearinghouse reports that

[2] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[3] Montana Public Benefits Fund Page, DSIRE database, "Universal System Benefits Program," available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MT01R&re=1&ee=1, accessed June 4, 2014.
[4] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 4, 2014.
[5] LIHEAP Clearinghouse Montana Profile, available at http://liheap.ncat.org/profiles/Montana.htm,accessed June 4, 2014.
[6] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 4, 2014.
[7] Low Income Discounts are offered under the Universal Systems Benefit Program (USBP).
[8] LIHEAP Montana State Snapshot, available at http://liheap.ncat.org/dereg/states/mtsnapshot.htm, accessed June 4, 2014.

the FWP "provides audits, air-sealing, hot water conservation, insulation, CFLs, heating equipment tune-up/ repair, [and] fuel switching (electric heat to gas) as appropriate." Additional utilities offer weatherization programs in coordination with Montana's Weatherization Assistance Program.

- *Funding Mechanism:* Funding for the program is generated from the USBP charge on all electric and natural gas IOU ratepayers and rural electric cooperatives.
- *Administration:* The Commission administers this program in coordination with LIHEAP and the larger utilities involved with WAP.[9]

In addition to the ratepayer funded programs listed above, utilities also offer rate assistance and energy efficiency programs to low-income customers. Examples of each include, but are not limited to, the following:[10]

Low-Income Rate Assistance:

- Flathead Electric Cooperative offers low-income residents at or below 150% of the federal poverty level with a credit to their monthly electric bill.
- Park Electric Co-op offers a Senior Income Eligible Discount to LIHEAP-eligible co-op members over the age of 60.
- Lincoln Electric Co-op offers a 10% energy bill discount to low-income seniors over 65 and permanently disabled residents.
- Vigilante Electric Cooperative, Inc. offers energy assistance to low-income households in the fall months.

Low-Income Energy Efficiency:

- Energy West and Montana-Dakota Utilities each run Furnace and Water Heater Safety and Efficiency Programs in which low-income household appliances are inspected and replaced if deemed unsafe.
- NorthWestern Energy, in collaboration with Montana's state weatherization program, offers a Free Weatherization Program to eligible homeowners.

In addition to the ratepayer- and utility-based programs listed above, the state also has charitable assistance in the event of crises. For example, Energy Share of Montana is a non-profit organization that provides one-time needs-based assistance to state residents. Assistance may come in the form of appliance repairs or installation, but most often comes in the form of help with heating bill payments. Additionally, Flathead Electric offers the Keep the Lights On program "provides help in emergencies for low-income members who are in disconnect status."[11]

[9] LIHEAP Montana State Snapshot, available at http://liheap.ncat.org/dereg/states/mtsnapshot.htm, accessed June 4, 2014.
[10] LIHEAP Clearinghouse Montana Profile, available at http://liheap.ncat.org/profiles/Montana.htm, accessed June 4, 2014.
[11] LIHEAP Clearinghouse Montana Profile, available at http://liheap.ncat.org/profiles/Montana.htm, accessed June 4, 2014.

NEVADA

Summary

- **State ratemaking practices**
  - Just and reasonable rates for all customers
- **Collection of energy efficiency (and other) public benefit revenues**
  - The PUC oversees the collection and spending of the Fund for Energy Assistance and Conservation
- **Disbursement of energy efficiency revenues**
  - Energy efficiency spending in 2012 was 56% residential and 44% commercial
- **Protection of low-income customers**
  - Low-income rates: Certain utilities offer low-income customers annual credits
  - Ratepayer-funded low-income programs totaled $9.1 million toward rate assistance and $3.25 million toward energy efficiency in 2012
  - Nevada has low-income rate assistance, energy efficiency, arrears management, and emergency charitable programs available for eligible low-income customers
  - LIHEAP funding in 2014: $11,103,694

State ratemaking practices:

Nevada law requires that the Public Utilities Commission (Commission) set rates to be "just and reasonable" for all customers.[1]

Collection of energy efficiency (and other) public benefit revenues:

Nevada established the Fund for Energy Assistance and Conservation (Fund) which is administered by the Division of Welfare and Supportive Services. Fund revenues come from the universal energy charge, a surcharge of 0.39 mills on each kwh of electricity for retail customer purchases for consumption in Nevada. Nevada law mandates that 75% of the money in the Fund be distributed to assist eligible households for natural gas and electric payments.

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Nevada in 2012 was distributed in the following way: 56% of spending was on residential customers and 44% was on commercial customers.[2] This is in rough proportion to the electric revenues collected from each rate class.[3]

Protection of low-income customers:

LIHEAP provides states with federal funding to assist low-income utility customers with their home energy bills. For Nevada, funding for fiscal year 2014 totaled $11,103,694. Customers whose income is 150% of the federal poverty level are LIHEAP-eligible. An estimated 30,000 households benefited from

[1] Nevada State Law, Chapter 704 – Regulation of Public Utilities Generally, Section 120.
[2] Percentages reflect EE and Load Management Program costs from EIA data.
[3] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.

LIHEAP heat assistance in fiscal year 2013. As an example, LIHEAP benefits for fiscal year 2013 included a minimum of $180, but average of $684 in benefits.[4]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency by state for certain states. The most recent data from 2012 lists a total of $9.1 million in ratepayer funds dedicated toward low-income rate assistance, and $3.25 million in ratepayer funds dedicated toward low-income energy efficiency.[5] These numbers include totals from state- and utility-administered programs.

Nevada has several ratepayer funded low-income rate assistance and energy efficiency programs. Participating utilities include NV Energy and Southwest Gas.[6] A sampling of such programs is listed below:

- Low-income rate assistance comes from Nevada's Energy Assistance Program.
    - The program provides annual credits for low-income customers. The program reduces participants' percentage of income paid on utility bills to the state median percentage of income spent on such bills.
- There are two main ratepayer funded programs that address energy efficiency in Nevada.
    - The UEC Weatherization Assistance Program provides various services to improve health and safety measures. The program served 756 households with $3 million in funding for 2012.
    - There are also a number of demand side management programs in place for households. In 2012, Southwest Gas demand side management program funding was $247,500 and reached 269 households.

In addition to the above utility-administered programs, there are multiple emergency charitable assistance programs in place.[7] A few examples are below:

- NV Energy helps facilitate energy assistance programs.
    - Project REACH helps adults by providing relief through energy assistance and is administered by the United Way of Southern Nevada. Eligible customers include individuals over the age of 62 that are isolated, medically fragile in need of emergency energy assistance.
    - The Community Services Agency administers the Special Assistance Fund for Energy. The program is a low-income energy assistance programs were shareholder funds match public donations on a dollar for dollar basis up to $100,000.
- Southwest Gas's Energy Share program offers direct assistance to those with unexpected financial difficulties. The program is administered by the Salvation Army.
- Valley Electric Associations works with county social service agencies to provide assistance to customers that are having difficulty paying their electric bill.

[4] LIHEAP Clearinghouse Nevada Profile, available at http://liheap.ncat.org/profiles/Nevada.htm, accessed June 3, 2014.
[5] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.
[6] LIHEAP Nevada Snapshot, available at http://liheap.ncat.org/dereg/states/nvsnapshot.htm, accessed June 3, 2014.
[7] LIHEAP Clearinghouse Nevada Profile, available at http://liheap.ncat.org/profiles/Nevada.htm, accessed June 3, 2014.

NEW HAMPSHIRE

Summary

- **State ratemaking practices**
  - Fair and reasonable allocation of utility costs to customers.
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Commission has overseen the collection and spending of public benefit funding mechanisms for 18 years
  - Public benefit funding collected from customers on a volumetric basis
  - Additional energy efficiency funding was made available through the conversion of the state's greenhouse gas emissions fund in 2012
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues from residential customers are spent in rough proportion to the dollars collected within that rate class
  - Energy efficiency spending in 2012 was 46% residential, 53% commercial, and 2% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $15.1 million toward rate assistance and $3.9 million toward energy efficiency in 2012
  - State-mandated ratepayer-funded rate assistance and energy efficiency programs
  - Charitable rate assistance programs also exist
  - LIHEAP funding in 2014: $25,536,004

State ratemaking practices:

New Hampshire has laws in place to ensure fair ratemaking practices. New Hampshire Statutes, §378:10 states, "No public utility shall make or give any undue or unreasonable preference or advantage to any person or corporation, or to any locality, or to any particular description of service in any respect whatever or subject any particular person or corporation or locality, or any particular description of service, to any undue or unreasonable prejudice or disadvantage in any respect whatever."[1]

Collection of energy efficiency (and other) public benefit revenues:

Electric restructuring legislation in 1996 created a system benefit charge (SBC) that supports low-income rate assistance and energy efficiency programs. The efficiency fund took effect in 2002 and is funded by a $0.0018/kWh charge on electric utility customers, with a separate $0.0015/kWh customer charge to fund low-income energy assistance. This adds up to approximately $19 million collected annually from the surcharges. The New Hampshire Public Utilities Commission (PUC) approves programs that receive funding from the SBC and oversees these utility-administered programs. The PUC also provides annual reports on the SBC to the Legislative Oversight Committee on Electric Restructuring.[2]

[1] New Hampshire Statutes, Title XXXIV, §378:10.
[2] DSIRE database, New Hampshire System Benefits Charge, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NH07R&re=1&ee=1, accessed June 9, 2014.

In 2012, New Hampshire legislation converted the greenhouse gas emissions fund into an energy efficiency fund, which will provide additional funding for energy programs funded by SBCs.[3]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in New Hampshire in 2012 was distributed in the following way: 46% of spending was on residential customers, 53% was on commercial customers, and 2% was on industrial customers.[4] This is in rough proportion to the electric revenues collected from each rate class.[5]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For New Hampshire, funding for 2014 totaled $25,536,004. Customers whose income is not greater than 200% of the Federal Poverty Level are LIHEAP-eligible. An estimated 36,805 households benefited from LIHEAP heat assistance in 2013. Eligible customers in 2013 received a minimum heating benefit of $120, with $500 awarded on average.[6]

A state statute from the 1840's mandates that New Hampshire cities and towns provide emergency welfare services to the poor. This assistance is funded through local property taxes and includes utility payment assistance, food and clothing vouchers, and burial expenses.[7]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists a total of $15.1 million in ratepayer funds dedicated toward low-income rate assistance, and $3.9 million in ratepayer funds dedicated toward low-income energy efficiency.[8] These numbers include totals from state- and utility-administered programs.

Many utilities participate in rate assistance and energy efficiency programs funded through a system benefits charge of $003.3/kWh. These programs are administered by the utilities with PUC oversight. Programs for Public Service Company of New Hampshire, Granite State Electric, Unitil Energy Systems, Inc., and New Hampshire electric Cooperative are summarized below:

- The Electric Assistance Program (EAP) provides monthly electric bill discounts for low-income customers with household income at or below 175% of the federal poverty level. Discounts range from 7 to 70 percent off the first 700 kWh of energy used, with discounts ranging based on income level and size of household. EAP funding in 2012 totaled $13.6 million.
- The Home Energy Assistance (HEA) program provides up to $5,000 in energy efficiency improvements for customers of participating utilities whose income is less than 200% of the

[3] DSIRE database, New Hampshire System Benefits Charge, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NH07R&re=1&ee=1, accessed June 9, 2014.
[4] Percentages reflect EE and Load Management Program costs from EIA data.
[5] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.
[6] LIHEAP Clearinghouse New Hampshire Profile, available at http://liheap.ncat.org/profiles/NH.htm, accessed June 9, 2014.
[7] LIHEAP Clearinghouse New Hampshire Profile, available at http://liheap.ncat.org/profiles/NH.htm, accessed June 9, 2014.
[8] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 9, 2014.

federal poverty level. Improvements include insulation, weatherization, appliance upgrades, and health and safety measures. HEA electric utility funding in 2012 totaled $3 million.[9]

In addition to the state-mandated ratepayer funded programs listed above, charitable programs for rate assistance are also available. Many of New Hampshire's utilities participate in Neighbors Helping Neighbors, which is a "last resort" fund to help protect low-income customers from disruption in energy service once other funds have fun out. New Hampshire Electric Cooperative's Project Care works similarly, providing help to members to avoid disconnection in service. Project Care is funded through the Round Up program, where members choose to "round up" their utility bills to the nearest dollar to help with funding.[10]

[9] LIHEAP New Hampshire State Snapshot, available at http://liheap.ncat.org/dereg/states/nhsnapshot.htm, accessed June 9, 2014.
[10] LIHEAP New Hampshire State Snapshot, available at http://liheap.ncat.org/dereg/states/nhsnapshot.htm, accessed June 9, 2014.

NEW JERSEY

Summary

- **State ratemaking practices**
  - Just and reasonable allocation of utility costs to rate classes
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Board of Public Utilities has administered the public benefit fund for 15 years
  - Public benefit funding is a non-bypassable charge and collected on a volumetric basis
- **Disbursement of energy efficiency revenues**
  - Energy efficiency spending in 2012 was 75% residential, 20% commercial, and 5% industrial
- **Protection of low-income customers**
  - Low-income rates: there is a low-income discount on natural gas and electricity bills
  - Ratepayer-funded low-income programs totaled $273.15 million toward rate assistance and $30 million toward energy efficiency in 2012
  - New Jersey also has arrearage management programs
  - LIHEAP funding in 2014: $ 124,569,647

State ratemaking practices:

The state of New Jersey works toward just and reasonable allocation of utility costs to rate classes. New Jersey Statute states, "The board may, after hearing… [f]ix just and reasonable individual rates, joint rates, tolls, charges or schedules thereof, as well as commutation, mileage and other special rates which shall be imposed, observed and followed thereafter by any public utility, whenever the board shall determine any existing rate, toll, charge or schedule thereof, commutation, mileage or other special rate to be unjust, unreasonable, insufficient or unjustly discriminatory or preferential."[1]

Collection of energy efficiency (and other) public benefit revenues:

As part of electric-utility restructuring legislation, New Jersey established a public benefit fund in 1999 to fund renewable energy, energy efficiency, and low-income assistance programs through the New Jersey Clean Energy Program (NJCEP). The NJCEP is administered by the Board of Public Utilities (BPU). NJCEP funds are generated from collection of what is known as the "societal benefits charge" (SBC). DSIRE reports that the SBC is a non-bypassable, per-kWh surcharge imposed on customers of NJ's seven investor-owned gas and electric public utilities. The magnitude of the SBC varies as the BPU sets three-year period funding targets. From 2001-2004, a total of $482 million was collected and from 2005-2008, a total of $745 million was collected. The 2009-2012 budget was set at $1.213 billion with approximately 80% of funds directed to energy efficiency programs and 20% to renewable energy programs. DSIRE notes that New York's NJCEP target budgets may also be affected by a variety of factors over the course of a funding period, including: interest accruals, budget re-allocations, alternative compliance payment

[1] New Jersey Statute §48:2-21.

funds, and amounts routed out of the fund to external state needs.[2] Until state Governor Chris Christie withdrew New Jersey from the RGGI program in 2011, the SBC received additional revenues from RGGI auction proceeds.[3]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in New Jersey in 2012 was distributed in the following way: 75% of spending was on residential customers, 20% was on commercial customers, and 5% was on industrial customers.[4]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. New Jersey LIHEAP funding is currently set at approximately $124.5 million for 2014. To be LIHEAP-eligible, utility customers must have a household income of no greater than 200% the federal poverty guidelines. For fiscal year 2013, this funding reached an estimated 190,432 households. For fiscal year 2012, LIHEAP households received an average benefit of $275 for heating and $160 for "medically necessary cooling."[5]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency by state for certain states. The most recent data New Jersey data from 2012 lists a total of approximately $273.15 million in ratepayer funds dedicated toward low-income rate assistance and $30 million in ratepayer funds dedicated toward low-income energy efficiency.[6] These numbers include totals from state- and utility-administered programs.

New Jersey has several low-income rate assistance programs, an energy efficiency program, and arrears management that are administered by utilities, state departments, and non-profit entities with regulatory oversight. Participating utilities include a number of gas and electric providers: "PSE&G, Elizabethtown Gas, NJ Natural Gas, South Jersey Gas, Atlantic City Electric, Jersey Central P&L, Rockland Electric." Funding for all of the ratepayer programs is generated from the SBC on all electric and natural gas consumers.[7] The current programs for each category are outlined below:

Rate Assistance

- Universal Service Fund (USF) offers energy bill credits of up to $1,800 annually to customers who fall under the 150% federal poverty guidelines and direct more than 6% of their income to gas and electricity. The USF is administered by the Department of Community Affairs as a LIHEAP grantee. In 2012, the USF received $197 million in funding and served an estimated 221,451 households.

[2] "Societal Benefits Charge," Database of State Incentives for Renewables & Efficiency (DSIRE), New Jersey Incentives/Policies for Renewables & Efficiency, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NJ04R&re=1&ee=1, accessed June 11, 2014.
[3] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[4] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.
[5] LIHEAP Clearinghouse New Jersey Profile, available at http://liheap.ncat.org/profiles/NJ.htm, accessed June 13, 2014.
[6] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.
[7] LIHEAP New Jersey State Snapshot, available at http://liheap.ncat.org/dereg/states/njsnapshot.htm, accessed June 13, 2014.

- Temporary Relief for Utility Expenses (TRUE) offers one-time credit of $1,500 to overdue electric or gas bills to customers who may be ineligible for LIHEAP or USF support, but have a record of timely energy bill payments. TRUE is administered by the Affordable Housing Alliance. In 2012, TRUE received a "one-time funding" amount of $25 million for the 2011-2015 period.
- Lifeline offers elderly and disabled customers up to $225 in rate assistance. The program is administered by the Department of Human Services. In 2012, Lifeline received $65 million in funding and served an estimated 281,855 households.

Arrearage Management

- Fresh Start offers arrearage forgiveness to first-year enrollees of the USF if a customer enters the program with at least $60 in overdue, but pays all monthly utility bills in full and on time for the course of a year. Fresh Start is managed by the Department of Community Affairs as a LIHEAP grantee. In 2012, the Fresh Start program received $12.4 million in funding and served an estimated 24,360 households.

Energy Efficiency

- Comfort Partners repairs, replaces, and installs energy efficient appliances of customers with income no greater than 225% of the federal poverty guidelines, prioritizing USF participants with higher energy use. Comfort Partners is administered by utilities and the office BPU Office of Clean Energy. In 2012, Comfort Partners received $33.3 million in funding and served an estimated 7,897 households.

In addition to the ratepayer funded programs listed above, utilities also offer rate assistance and energy efficiency programs to low-income customers. An example includes, but is not limited to, the following:

- Payment Assistance for Gas & Electric offers assistance to "low-to-moderate income" state residents experiencing economic hardship and facing difficulty paying utility bills. To be eligible for assistance, customers must have overdue bills or be in disconnect status, must have a recent history of consistent payments prior to hardship, meet specific program income guidelines, and not have received USF within 6 months.[8]

Charitable Assistance

In addition to the ratepayer- and utility-based programs listed above, New Jersey also has charitable assistance in the event of crises. For example, New Jersey SHARES offers temporary energy bill assistance to non-welfare residents of the state who are experiencing financial hardship, but have "demonstrated a good faith effort to pay their energy bills." Additionally, New Jersey Natural Gas offers the Gift of Warmth program which provides utility bill assistance to low-income customers experiencing financial hardship.[9]

[8] LIHEAP Clearinghouse New Jersey Profile, available at http://liheap.ncat.org/profiles/NJ.htm, accessed June 13, 2014.
[9] "[The Gift of Warmth] program is administered by the United Way through local Community Action Program (CAP) agencies." LIHEAP Clearinghouse New Jersey Profile, available at http://liheap.ncat.org/profiles/NJ.htm, accessed June 13, 2014.

NEW MEXICO

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - Public Regulation Commission and utilities have overseen the collection and spending of public benefit funding mechanisms for 9 years
  - Different policies are in place for IOUs, distribution co-ops and electric co-ops
  - Charges are collected by utilities
- **Disbursement of energy efficiency revenues**
  - Energy efficiency spending in 2012 was 54% residential, 38% commercial, and 8% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $1.8 million toward energy efficiency in 2012
  - State-mandated ratepayer funded energy efficiency program
  - Charitable rate assistance programs also available
  - LIHEAP funding in 2014: $16,734,368

State ratemaking practices:

The New Mexico statutes help ensure fair ratemaking practices for all utility customers. The law states, "Every rate made, demanded or received by any public utility shall be just and reasonable."[1] In addition, a specific clause covering discrimination outlines that "No public utility shall, as to rates or services, make or grant any unreasonable preference or advantage to any corporation or person within any classification or subject any corporation or person within any classification to any unreasonable prejudice or disadvantage," and further clarifies that "No public utility shall establish and maintain any unreasonable differences as to rates of service either as between localities or as between classes of service." Finally, the law provides special considerations concerning the protection of low-income ratepayers, stating "Nothing shall prohibit, however, the commission from approving economic development rates and rates designed to retain load or from approving energy efficiency programs designed to reduce the burden of energy costs on low-income customers pursuant to the Efficient Use of Energy Act."[2]

Collection of energy efficiency (and other) public benefit revenues:

In 2005, the Efficient Use of Energy Act created a public benefits charge that utilities could levy to implement energy efficiency programs. Utilities are allowed to charge customers to obtain funding for energy efficiency and load management programs, with a tariff that cannot exceed $75,000 per year per customer. All programs must be approved by the Public Regulation Commission (Commission) before

[1] New Mexico state statutes, 62-8-1.
[2] New Mexico state statutes, 62-8-6.

they can be implemented by utilities, and all IOUs have established programs and received approval by the Commission.[3]

Approval for electric cooperative energy efficiency programs resides with each co-op's governing body, but the co-ops must also provide written submission of their programs to the Commission. Distribution co-ops are allowed to collect a renewable energy and conservation fee of up to 1% of the customer's bill, and are allowed to spend the funds on projects and programs related to renewable energy, load management, and energy efficiency.[4]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in New Mexico in 2012 was distributed in the following way: 54% of spending was on residential customers, 38% was on commercial customers, and 8% was on industrial customers.[5]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For New Mexico, funding for 2014 totaled $16,734,368. Customers whose income is not greater than 150% of the federal poverty level are LIHEAP-eligible. An estimated 68,462 households benefited from LIHEAP heat assistance in 2013. The amount of money spent on heating and cooling for LIHEAP customers ranged between $32 and $224, and customers could receive up to $224 to deal with a crisis.[6]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists $1.8 million in ratepayer funds dedicated toward low-income energy efficiency.[7] These numbers include totals from state- and utility-administered programs.

As mentioned above, public benefits funds are collected by utilities for energy efficiency programs. In addition, many charitable low-income assistance programs exist. A few examples are provided below:

- The Public Service Company of New Mexico (PNM) has a Good Neighbor Fund, where customer donations are matched by PNM and funds go toward rate assistance for low-income customers between November and April. The Fund is administered by the Salvation Army.
- Several programs for help exist in Bernalillo County:
    - St. Vincent De Paul, a Catholic aid organization, provides electricity, gas, and water assistance.
    - The Home Education Livelihood Program (HELP) provides utility rate assistance, rent assistance, or food vouchers once per year for eligible low-income households.

[3] DSIRE database, New Mexico Efficient Use of Energy Act, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NM09R&re=1&ee=1, accessed June 9, 2014.
[4] DSIRE database, New Mexico Efficient Use of Energy Act, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NM09R&re=1&ee=1, accessed June 9, 2014.
[5] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/. Percentages reflect EE and Load Management Program costs from EIA data.
[6] LIHEAP Clearinghouse New Mexico Profile, available at http://liheap.ncat.org/profiles/NM.htm, accessed June 9, 2014.
[7] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.

  - Silver Horizons provides assistance to residents over age 60 who have received a disconnection notice.
- El Paso Electric's Project Care matches employee and customer donations with contributions by EPE shareholders to help families unable to pay their electricity bills because of medical or financial problems. The El Paso County General Assistance administers the fund.[8]

[8] LIHEAP Clearinghouse New Mexico Profile, available at http://liheap.ncat.org/profiles/NM.htm, accessed June 9, 2014.

NEW YORK

Summary

- **State ratemaking practices**
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - The public benefit fund was established by the Comission18 years ago and is administered by the New York State Research and Development Authority
  - The Commission establishes " annual collection targets" for participating utilities
  - Public benefit funding is collected as a surcharge on energy bills issued to the customers of participating utilities
- **Disbursement of energy efficiency revenues**
  - Energy efficiency spending in 2012 was 24% residential, 70% commercial, and 7% industrial
- **Protection of low-income customers**
  - Low-income rates: there is a low-income discount on gas and electricity bills
  - Ratepayer-funded low-income programs totaled $112 million toward rate assistance and $40 million toward energy efficiency in 2012
  - Arrearage management and forgiveness
  - Charitable emergency assistance - for heat, electricity, and other items - is offered to communities in crisis
  - LIHEAP funding in 2014: $366,843,330

State ratemaking practices:

New York works toward low-income considerations. A 2014 Con Edison rate case ordered low-income considerations into effect by stating, "In addition to stabilizing delivery charges to customers, other benefits for customers include: Improving and increasing the discounts associated with the electric and gas low-income programs…"[1]

Collection of energy efficiency (and other) public benefit revenues:

New York's Public Service Commission (PSC) established a public benefit fund in 1996 to support energy efficiency, education and outreach, research and development, and low-income energy assistance programs. The fund is administered by the New York State Research and Development Authority (NYSERDA). Revenue for the fund is generated through a system benefits charge (SBC) issued to customers of the state's six investor-owned utilities (IOUs) as a surcharge on utility bills. Only the IOU customers paying the SBC are eligible for program benefits. Customers of municipal utilities and electric cooperatives are not eligible beneficiaries. Additionally, customers of Long Island Power Authority (LIPA) and the New York Power Authority (NYPA) are not eligible to benefit from SBC-funded

[1] Con Edison Rate Case - Docket 13-E-0030 (Final Order Issued February 20, 2014).

initiatives, but are offered separate programs.[2] The public benefit fund receives additional revenues from RGGI auction proceeds since New York is a participating state.[3]

The SBC has evolved over the years, with multiple iterations released since its inception in 1996. While the charge was first set to run through 2011, the PSC extended the program term out to 2016 in 2011.[4] Throughout the years, the efforts of the fund have also evolved to avoid duplicity with other state programs that support energy efficiency and renewable energy efforts, such as the Energy Efficiency Portfolio Standard (EEPS) and the Renewable Portfolio Standard (RPS). Iterations of the SBC have shifted various programs to be under domain of these additional state programs. Additionally, the PSC orders that any uncommitted SBC funds be directed towards efforts external to the fund, such as the Technology and Market Development Portfolio.

Each year, the PSC establishes public benefit fund "collection targets" for participating utilities. The fund's budget has grown over its years in existence: the SBC budget totaled $234 million between 1998 and 2001, $750 million by 2006, and $1.89 billion by 2011. Moreover, these budget totals are not reflective of the complete universe of programs that the state offers to support energy efficiency and renewable energy.[5]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in New York in 2012 was distributed in the following way: 24% of spending was on residential customers, 70% was on commercial customers, and 7% was on industrial customers.[6]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. New York LIHEAP funding is currently set at approximately $366.8 million for 2014. LIHEAP funding reached an estimated 2,564 household with cooling assistance in 2014 and an estimated 1.46 million households for heating in 2013. LIHEAP heating benefits for 2013 included a minimum of $50 and an average of $338. Maximums of LIHEAP heating benefits varied by fuel type with a maximum of $6,000 for oil, kerosene, or propane; $500 for wood, coal, or other deliverable fuels; and $400 for natural gas and electric. Customers eligible for LIHEAP are those whose income is not greater than 60% of the state median income.[7]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency by state for certain states. The most recent New York

[2] "Systems Benefits Charge," Database of State Incentives for Renewables & Efficiency (DSIRE), Massachusetts Incentives/Policies for Renewables & Efficiency, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY07R&re=1&ee=1, accessed June 3, 2014.
[3] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[4] Order Continuing the System Benefits Charge and Approving an Operating Plan for a Technology and Market Development Portfolio of System Benefits Charge Funded Programs, State of New York Public Service Commission, Case 10-M-0457 - In the Matter of the System Benefits Charge IV, October 13, 2011.
[5] Order Continuing the System Benefits Charge and Approving an Operating Plan for a Technology and Market Development Portfolio of System Benefits Charge Funded Programs, State of New York Public Service Commission, Case 10-M-0457 - In the Matter of the System Benefits Charge IV, October 13, 2011.
[6] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.
[7] LIHEAP Clearinghouse New York Profile, available at http://liheap.ncat.org/profiles/NY.htm, accessed June 10, 2014.

data from 2012 lists a total of $112 million in ratepayer funds dedicated toward low-income rate assistance, and $40 million in ratepayer funds dedicated toward low-income energy efficiency.[8] These numbers include totals from state- and utility-administered programs.

New York has several low-income rate assistance and energy efficiency programs that are overseen with regulatory oversight. Participating utilities include: Consolidated Edison, National Grid, New York State Electric and Gas, KeySpan Energy New York, KeySpan Energy Long Island, National Fuel Gas, Central Hudson, Orange and Rockland, Rochester Gas and Electric, Corning and St. Lawrence. Assistance offered is outlined below.

Rate Assistance Programs

- Individual utilities administer a variety of monthly gas and electric bill discounts to customers facing financial difficulty or recipients of other assistance such as LIHEAP, Supplemental Social Security Income, Temporary Assistance for Needy Families, Supplemental Nutrition Assistance Program, Medicaid, or Veterans benefits. The rate assistance programs are funded by individual rate case settlements.

Energy Efficiency

- EmPower New York offers energy education, and appliance and insulation assessment and replacement to utility customers whose income is 60% or less of the state median income, is eligible to receive LIHEAP or utility rate assistance program benefits, and lives in a building with less than 100 units. EmPower New York is administered by NYSERDA and funded by revenues generated from the SBC on utility customers.

Arrearage Management

- New York has a variety of arrearage management programs, offering various degrees of assistance. LIHEAP Clearinghouse reports the following list of programs:[9]

    - EPOP: 1/24th of arrears forgiven monthly
    - On-Track: Up to $400 in 4 payments over 18 months
    - LICAAP: 1/24th of arrears forgiven monthly
    - AffordAbility: Matching credit up to $30/ month
    - NYSEG EAP: 1/24th of arrears forgiven monthly (up to $750)
    - RG&E EAP: 1/24th of arrears forgiven monthly (up to $750)

[8] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.
[9] LIHEAP New York State Snapshot, available at http://liheap.ncat.org/dereg/states/nysnapshot.htm, accessed June 13, 2014.

Charitable Assistance

In addition to the ratepayer- and utility-based programs listed above, various entities within the state also offer charitable assistance in the event of crises. For example, various utility companies and counties offer state residents experiencing difficulty paying utility bills a range of assistance including, but not limited to, one-time payment assistance and/or appliance repair.[10, 11]

[10] LIHEAP Clearinghouse New York Profile, available at http://liheap.ncat.org/profiles/NY.htm, accessed June 10, 2014.
[11] LIHEAP Clearinghouse lists the following utilities as participating in emergency charitable assistance programs: Central Hudson Gas & Electric, KeySpan, Long Island Power Authority, National Fuel Gas Company, National Grid, New York State Electric and gas, Niagara Mohawk Power Corporation, Orange County Fuel Fund, Orange and Rockland Utilities, and Rochester Gas and Electric Corporation.

NORTH CAROLINA

Summary

- **State ratemaking practices**
  - Just and reasonable rates for all customers
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Commission has overseen public benefit funding since 1980
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected from rate classes
  - Energy efficiency spending in 2012 was 55% residential, 37% commercial, and 8% industrial
- **Protection of low-income customers**
  - Multiple energy efficiency and charitable assistance programs are in place
  - Duke Energy recently made a $10 million contribution to assist low-income customers
  - LIHEAP funding in 2014: $88,270,604

State ratemaking practices:

The North Carolina Utilities Commission (Commission) works to "provide just and reasonable rates and charges for public utility services without unjust discrimination, undue preferences or advantages, or unfair or destructive competitive practices and consistent with long-term management and conservation of energy resources by avoiding wasteful, uneconomic and inefficient uses of energy."[1]

Collection of energy efficiency (and other) public benefit revenues:

In 1980, the Commission established a public benefit fund for renewable energy programs. The Commission provides oversight, but the fund is administered by the North Carolina Advanced Energy Corporation. The charge is 0.03 mills per kWh.[2]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in North Carolina in 2012 was distributed in the following way: 55% of spending was on residential customers, 37% was on commercial customers, and 8% was on industrial customers.[3] This is roughly proportional to the electric revenues collected from each customer class.[4]

[1] North Carolina state law §62-1 and §62-133.8 Subs. h-4.
[2] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.
[3] Percentages reflect EE and Load Management Program costs from EIA data.
[4] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.

Protection of low-income customers:

LIHEAP provides states with federal funding to assist low-income utility customers with their home energy bills. North Carolina LIHEAP funding is currently set at approximately $88.27 million for 2014. LIHEAP eligible customers for heating and cooling include those at 135% of the federal poverty level. An estimated 88,260 households benefited from LIHEAP heat assistance in 2013, and 35,242 households benefited from cooling. As an example, LIHEAP benefits for 2013 included a minimum benefit of $200 and a maximum of $400.[5]

There are a number of utility run low-income energy efficiency programs in place in North Carolina. Examples of such programs are included below:

- In addition to general energy efficiency programs, Duke Energy offers a low-income energy efficiency and weatherization program.
- Duke Energy Progress initiated a new Residential Neighborhood Energy Saver program after Senate Bill 3 passed in 2007. The program is targeted at low-income customers. Between 2009 and 2013, program expenditures totaled $10.1 million.
- In 2011, the Commission approved Dominion's residential low-income energy efficiency program.[6]

North Carolina has several charitable assistance programs in place. A few examples are below:

- A number of electric co-ops and utilities participate in Operating Roundup. The program uses customer donations to provide funds for individuals and organizations and include activities such as heating system repair.
- Cape Hatteras Electric facilities the Cape Hatteras Electric Foundation which uses customer donations to pay for humane needs.
- Wake County uses citizens' voluntary contributions to supply families and individuals with funds to cover heating costs during the winter.
- Duke Energy has a number of programs in place in North Carolina:
    - Share the Warmth uses contributions for heating bill assistance. The Duke Energy Foundation matches individual contributions dollar-for-dollar up to $50, and matches corporate contributions up to $500,000 each year.
    - Duke also has a Fan-Heat Relief Program that uses up to $40,000 annually for the purchase of fans for senior citizens.[7]
    - In a recent rate case settlement agreement, Duke Energy made a one-time $10 million contribution to assist low-income customers.[8]

[5] LIHEAP Clearinghouse North Carolina Profile, available at http://liheap.ncat.org/profiles/NC.htm, accessed June 3, 2014.
[6] Biennial Report of the North Carolina Utilities Commission to the Governor of North Carolina and the Joint Legislative commission in Governmental Operations Regarding Proceedings for Electric Power Suppliers Involving Energy Efficiency and Demand-Side Management Programs, Cost Recovery and Incentives, August 30, 2013.
[7] LIHEAP Clearinghouse North Carolina Profile, available at http://liheap.ncat.org/profiles/NC.htm, accessed June 3, 2014.
[8] "Rate Case Update," Duke Energy North Carolina, available at http://www.duke-energy.com/north-carolina/nc-rate-case.asp, accessed on June 6, 2014.

OHIO

Summary

- **State ratemaking practices**
  - Reasonable rates for all customers
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - PUC has overseen the collection and spending of public benefit funding mechanisms for 15 years
  - Public benefit funding collected from utility customers on a flat fee bases
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 43% residential, 34% commercial, and 22% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $477 million toward rate assistance and $58 million toward energy efficiency in 2012
  - State-mandated ratepayer-funded programs on regulated utilities related to rate assistance, arrearage management, and energy efficiency
  - Smaller utilities and co-ops offer energy efficiency programs
  - Charitable rate assistance programs also exist
  - LIHEAP funding in 2014: $154,313,750

State ratemaking practices:

It is Ohio state policy to "Ensure the availability to consumers of adequate, reliable, safe, efficient, nondiscriminatory, and reasonably priced retail electric service."[1] Special attention is also paid to low-income ratepayers: for example, Duke Energy has a separate rate class for rate low-income residential service.[2]

Collection of energy efficiency (and other) public benefit revenues:

The Ohio Advanced Energy Fund was established by legislation in 1999 as a result of electric restructuring. This fund supports energy efficiency, renewables, and low-income assistance programs. A flat fee is charged to electric utility customers and is determined by dividing target aggregate revenue by the number of customers.[3] The fund was authorized to collect $15 million each year from 2001-2005 and

[1] Ohio Revised Code (ORC), Title 49, 4928.02.
[2] Ohio Rate Case 12-1682-EL-AIR, order issued May 1, 2013.
[3] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.

$5 million per year from 2006-2010, and additional have been added from the Advanced Energy Research and Development Taxable Fund. The Ohio Development Services Agency administers the fund.[4]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Ohio in 2012 was distributed in the following way: 43% of spending was on residential customers, 34% was on commercial customers, and 22% was on industrial customers.[5] This is in rough proportion to the electric revenues collected from each rate class.[6]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Ohio, funding for 2014 totaled $154,313,750. Customers whose income is not greater than 175% of the Federal Poverty Guidelines are LIHEAP-eligible. An estimated 454,520 households benefited from LIHEAP heat assistance in 2013. As an example, LIHEAP benefits for 2013 included an average of $292 in heating benefits, along with winter crisis average assistance of $450 for regulated utilities and summer crisis average assistance of $175 for regulated utilities.[7]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists a total of $477 million in ratepayer funds dedicated toward low-income rate assistance, and $58 million in ratepayer funds dedicated toward low-income energy efficiency.[8] These numbers include totals from state- and utility-administered programs.

Regulated electric utilities are required to participate in the Percentage of Income Payment Plan (PIPP) and related programs funded by the electric universal service rider. These state-mandated programs provide rate assistance, energy efficiency, and arrearage management, and are highlighted below:[9]

- Rate Assistance: PIPP Plus sets the maximum rate that low-income customers must pay to the greater of 6% of their monthly income or $10 (for customers that heat with natural gas), or the greater of 10% of their monthly income or $10 (for customers with all-electric homes). PIPP Plus is administered by Ohio's LIHEAP office.
- Arrearage Management: On-time PIPP Plus payments are rewarded with an incentive credit and an arrearage credit. When a monthly PIPP Plus payment is made on-time and in full, the customer no longer owes the rest of that month's billed amount and receives credit for 1/24th of old debt, so that on-time payments for 24 months would eliminate all arrearages.
- Energy Efficiency: The Electric Partnership Program (EPP) is available to PIPP participants, and consists of base load efficiency component audits and insulation weatherization measures for participants with moderate to high energy usage related to heating.

[4] DSIRE database, Ohio Advanced Energy Fund, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OH11R&re=1&ee=1, accessed June 6, 2014.
[5] Percentages reflect EE and Load Management Program costs from EIA data.
[6] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 6, 2014.
[7] LIHEAP Clearinghouse Ohio Profile, available at http://liheap.ncat.org/profiles/Ohio.htm, accessed June 5, 2014.
[8] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm., accessed June 6, 2014.
[9] LIHEAP Clearinghouse Ohio Profile, available at http://liheap.ncat.org/profiles/Ohio.htm, and LIHEAP Clearinghouse Ohio State Snapshot, available at http://liheap.ncat.org/dereg/states/ohsnapshot.htm, accessed June 6, 2014.

- Participating utilities include Cleveland Electric Illuminating Company, Dayton Power & Light, Duke Energy Ohio, Ohio Edison Company, Toledo Edison Company, Columbus Southern Power Company, and Ohio Power Company.

In addition to the above state-mandated ratepayer funded programs, many regulated utilities offer additional programs. See examples below:[10]

- Dayton Power & Light offers an arrearage management program for customers who are no longer PIPP-eligible.
- Duke Energy provides rate assistance to customers who are below 200% of the federal poverty guidelines but are not enrolled in PIPP.

Other utilities not required to participate in PIPP offer energy efficiency programs in addition to the state-mandated EPP. Two examples are below:[11]

- American Electric Power offers weatherization assistance and repair services to customers enrolled in PIPP, the Home Weatherization Assistance Program, or the state LIHEAP program.
- Vectren also offers free energy efficiency measures to households whose income is 300% or less of the federal poverty level.

Finally, many utilities offer charitable programs to help with rate assistance. A selection of these programs is below:[12]

- American Electric Power's Neighbor to Neighbor Program is offered in partnership with the Dollar Energy Fund. Eligible customers receive a utility assistance grant on their electric bill.
- Ohio Edison, Cleveland Electric Illuminating Company, and Toledo Edison all offer one-time assistance to low-income or disabled customers who are at risk of disconnection. This program is administered through the Salvation Army.
- Consolidated Electric Cooperative receives customer donations to The People Fund, which is used for community needs not met through other agencies.

As a final measure of protection, in 2001 the State of Ohio created the Public Benefits Advisory Board, "which has the purpose of ensuring that energy services be provided to low-income consumers in this state in an affordable manner consistent with the policy specified in section 4928.02" of the ORC.[13]

[10] LIHEAP Clearinghouse Ohio Profile, available at http://liheap.ncat.org/profiles/Ohio.htm, accessed June 6, 2014.
[11] LIHEAP Clearinghouse Ohio Profile, available at http://liheap.ncat.org/profiles/Ohio.htm, accessed June 6, 2014.
[12] LIHEAP Clearinghouse Ohio Profile, available at http://liheap.ncat.org/profiles/Ohio.htm, accessed June 6, 2014.
[13] ORC 4928.58.

PENNSYLVANIA

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
- **Collection of energy efficiency (and other) public benefit revenues**
  - Four public benefit funds were established in 1996 as a result of utility restructuring
  - Public benefit funding collected from all rate classes, and all customers within rate classes, on a volumetric basis
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 48% residential, 31%commercial, and 21% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $339.7 million toward rate assistance and $42.5 million toward energy efficiency in 2011
  - State-mandated ratepayer funded rate assistance and energy efficiency programs
  - Charitable rate assistance and crisis management programs exist
  - LIHEAP funding in 2014: $203,071,386

State ratemaking practices:

Pennsylvania law provides protections for utility ratepayers. In the Public Utilities section of the Pennsylvania Consolidated Statutes, the law states, "Every rate made, demanded, or received by any public utility, or by any two or more public utilities jointly, shall be just and reasonable, and in conformity with regulations or orders of the commission."[1] The law provides even more detail related to ratemaking practices in specific instances. It reads that any distribution system improvement charge "shall be applied equally to all customer classes as a percentage of each customer's billed revenue."[2] Additionally, when setting rates related to energy efficiency and conservation programs, the law states that cost recovery must be structured "to ensure that measures approved are financed by the same customer class that will receive the direct energy and conservation benefits."[3]

Collection of energy efficiency (and other) public benefit revenues:

During electrical restructuring in 1996, settlements with Pennsylvania's five large distribution utilities resulted in the creation of four "Sustainable Energy Funds." The goals of these funds were to advance the development of clean and renewable energy, promote energy efficiency and conservation, and promote sustainable-energy business. Funds are collected through utilities' distribution rates on a per-kilowatt-hour basis. For example, the surcharge included in Pennsylvania Power & Light's (PP&L) distribution

[1] Pennsylvania Consolidated Statutes, Title 66, § 1301.
[2] Pennsylvania Consolidated Statutes, Title 66, § 1358.(d)(1).
[3] Pennsylvania Consolidated Statutes, Title 66, § 2806.1.(a)(11).

rates was $0.0001/kWh in 2005 and $0.00005/kWh in 2006. Each utility has an oversight board and a designated administrator for the funds, and the Pennsylvania Sustainable Energy Board oversees communication between the funds. The Board also provides annual reports on the projects supported by the funds, and has created guidelines with regard to the funds' business practices which were approved by the Public Utility Commission (PUC) in 2007.[4]

Total revenues collected from the four funds through 2012 totaled approximately $99 million. Currently, "the funds are transitioning toward a revolving loan and investment fund model in order to sustain their capital," and no revenue is currently being collected.[5]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Pennsylvania in 2012 was distributed in the following way: 48% of spending was on residential customers, 31% was on commercial customers, and 21% was on industrial customers.[6] This is in rough proportion to the electric revenues collected from each rate class.[7]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Pennsylvania, funding for 2014 totaled $203,071,386. Customers whose income is not greater than 150% of the Federal Poverty Guidelines are LIHEAP-eligible. An estimated 391,461 households benefited from LIHEAP heat assistance in 2013. For 2014, estimated LIHEAP benefits are $100-$1,000 for heating and $25-$500 for crisis.[8]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2011 lists a total of $339.7 million in ratepayer funds dedicated toward low-income rate assistance, and $42.5 million in ratepayer funds dedicated toward low-income energy efficiency.[9] These numbers include totals from state- and utility-administered programs.

[4] DSIRE database, Pennsylvania Public Benefits Programs, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=PA01R&re=1&ee=1, accessed June 9, 2014.
[5] DSIRE database, Pennsylvania Public Benefits Programs, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=PA01R&re=1&ee=1, accessed June 9, 2014.
[6] Percentages reflect EE and Load Management Program costs from EIA data.
[7] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 9, 2014.
[8] LIHEAP Clearinghouse Pennsylvania Profile, available at http://liheap.ncat.org/profiles/Penn.htm, accessed June 7, 2014.
[9] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.

Pennsylvania's major gas and electric utilities are required by law to provide Customer Assistance Programs to their low-income customers. These programs generally include rate assistance based on a percentage of income payment plan or a percentage of bill plan, and can also include arrearage management or bill credits. A few examples are below:[10]

- Duquesne Light offers arrearage forgiveness over time, reduced monthly payments based on customers' ability to pay, and protection against loss of electrical service. They also waive the security deposit for customers who qualify.[11]
- PECO offers a discounted residential tariff rate for low-income customers, with four different percentage discounts based on customers' household income.[12]
- Rate assistance funding totaled $234.4 million for electric utilities in 2012.[13]

Pennsylvania's major gas and electric utilities are also required to participate in the Low-Income Usage Reduction Program (LIURP). LIURP includes application assistance and education to address energy savings and regular bill payment behavior.[14] Programs are administered by the participating utilities, and energy efficiency funding totaled $26.5 million for electric utilities in 2012.[15]

In addition to the state-mandated ratepayer-funded rate assistance and energy efficiency programs, there are also charitable programs associated with the major utilities, smaller utilities, and coops that are available and provide rate assistance, along with programs unaffiliated with utilities that also provide assistance. A selection of these programs is below:[16]

- PP&L's Operation Help programs combines funds from PP&L, its customers, its employees, and its retirees to help customers pay any type of home heating bill. This program is administered by a network of social service agencies community groups throughout eastern and central Pennsylvania.
- Claverack Electric Cooperative collects member donations which go toward helping low-income and other in-need families with their electric bills.
- The Dollar Energy Hardship Fund is the fourth largest fuel fund in the US. Utilities partner with the fund and match customer donations and also provide donations to cover administrative expenses of the fund.
- The Philadelphia Utility Emergency Services Fund was created by utility companies, public officials, business leaders, and community organizations to help with energy crisis benefits. The three largest utilities in the state have a dollar-to-dollar matching programs for funds raised.

[10] LIHEAP Clearinghouse Pennsylvania Profile, available at http://liheap.ncat.org/profiles/Penn.htm, accessed June 9, 2014.
[11] Duquesne Light Customer Assistance Program, available at https://www.duquesnelight.com/forYourHome/SaveEnergyAndSaveMoney/AssistanceHelpForYourEnergyNeeds/CustomerAssistanceProgram.cfm, accessed June 9, 2014.
[12] LIHEAP Clearinghouse Pennsylvania Profile, available at http://liheap.ncat.org/profiles/Penn.htm, accessed June 9, 2014.
[13] LIHEAP Clearinghouse Pennsylvania State Snapshot, available at http://liheap.ncat.org/dereg/states/pasnapshot.htm, accessed June 9, 2014.
[14] LIHEAP Clearinghouse Pennsylvania Profile, available at http://liheap.ncat.org/profiles/Penn.htm, accessed June 9, 2014.
[15] LIHEAP Clearinghouse Pennsylvania State Snapshot, available at http://liheap.ncat.org/dereg/states/pasnapshot.htm, accessed June 9, 2014.
[16] LIHEAP Clearinghouse Pennsylvania Profile, available at http://liheap.ncat.org/profiles/Penn.htm, accessed June 9, 2014.

TEXAS

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to rate classes
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Commission has overseen the collection and spending of public benefit funding mechanisms for 15 years
  - Public benefit funding collected from retail electric customers of municipal utilities or coops in deregulated parts of Texas, on a volumetric basis
  - In addition to the PBF, Texas' EERS requires that funds be spent on energy efficiency. These mandated funds are collected through a charge approved by the PUC
- **Disbursement of energy efficiency revenues**
  - Energy efficiency spending in 2012 was 59% residential, 38% commercial, and 4% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $73.6 million toward rate assistance and $25.9 million toward energy efficiency in 2012
  - Ratepayer funded rate assistance and energy efficiency programs exist
  - Smaller utilities, municipals and coops also offer rate assistance and energy efficiency programs
  - Charitable rate assistance programs are also offered
  - LIHEAP funding in 2014: $128,686,252

State ratemaking practices:

The Texas Administrative Code has laws in place to ensure equity in ratemaking practices. When considering rate design, TAC Chapter 25, Subchapter J, §25.234 states, "Rates shall not be unreasonably preferential, prejudicial, or discriminatory, but shall be sufficient, equitable, and consistent in application to each class of customers, and shall be based on cost."[1]

In addition to ensuring equity across customer classes, special consideration is given to low-income customers. The Public Utilities Regulatory Act (PURA) highlights various protections for low-income customers, including mandated rate reduction in conjunction with the system benefit fund. In particular, PURA states, "The reduced rate for a retail electric provider shall result in a total charge that is at least 10 percent and, if sufficient money in the system benefit fund is available, up to 20 percent, lower than the amount the customer would otherwise be charged."[2]

[1] TAC Chapter 25, Subchapter J, §25.234.
[2] Public Utilities Regulatory Act (PURA), Title II, Sec. 39.903(h), effective September 1, 2013.

Collection of energy efficiency (and other) public benefit revenues:

Texas has a public benefit fund (PBF) which was established in 1999[3] during utility restructuring to provide funding for the Public Utility Commission's (PUC) Low-Income Discount Program, education programs, weatherization, and energy efficiency programs, along with helping to fund the cost of the restructuring. Utilities administer energy efficiency aspects of the PBF, and the PUC administers the low-income aspects and serves as the oversight body. The fee of up to $0.65/Mwh is levied on retail electric customers of municipal utilities or coops in deregulated parts of Texas. Estimated appropriations to the fund in 2013 were $86.1 million. Expenditures in 2012 totaled $69.7 million and were apportioned in the following way: 86.7% of funds went toward the Low-Income Discount Program, 12.8% went toward the PUC, and 0.6% was apportioned to customer education.[4]

In addition to the PBF, Texas enacted an Energy Efficiency Resource Standard (EERS) in 1999 that requires IOUs to meet energy efficiency goals related to reductions in peak demand. Currently, the EERS requires a 30% reduction in annual growth in demand.[5] Utilities fund the EERS through an energy efficiency cost recovery factor that is "directly assigned to each rate class that receives services under the programs to the maximum extent reasonably possible."[6]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Texas in 2012 was distributed in the following way: 59% of spending was on residential customers, 38% was on commercial customers, and 4% was on industrial customers.[7]

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Texas, funding for 2014 totaled $128,686,252. Customers whose income is not greater than 125% of the Federal Poverty Level are LIHEAP-eligible. An estimated 165,835 households benefited from LIHEAP cooling assistance in 2013, while an estimated 26,870 households benefitted from heating assistance. LIHEAP benefits for included maximum heating and cooling benefits of $1,000.[8]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2012 lists a total of $73.6 million in ratepayer funds dedicated toward low-income rate assistance and $25.9 million in ratepayer funds dedicated toward low-income energy efficiency.[9] These numbers include totals from state- and utility-administered programs.

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[3] PURA, Sec. 39.903.
[4] Issue Brief from the Legislative Budget Board Staff on the Texas System Benefit Fund, February 2013, available at http://www.lbb.state.tx.us/Documents/Publications/Issue_Briefs/343_System_Benefit_Fund.pdf, accessed June 5, 2014.
[5] DSIRE database Texas Energy Efficiency Goal, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX28R&re=1&ee=1, accessed June 5, 2014.
[6] TAC Chapter 25, Subchapter J, §25.181.
[7] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 5, 2014. Percentages reflect EE and Load Management Program costs from EIA data.
[8] LIHEAP Clearinghouse Texas Profile, available at http://liheap.ncat.org/profiles/Texas.htm, accessed June 5, 2014.
[9] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.

Texas has several ratepayer funded low-income rate assistance and energy efficiency programs offered by electric utilities. Several of such programs are listed below:

- LITE UP Texas is administered Solix with oversight by the PUC and provides a 10% discount on electrical bills for eligible low-income customers between May and August. Electric utilities participate in this program. Funding in 2012 totaled $73.6 million, and an estimated 920,000 households were served.
- The SBC weatherization program is offered in conjunction with the federal Weatherization Assistance Program and provides additional funds to help low-income customers with weatherization measures. Estimated funding in 2012 totaled $11.7 million.
- Utilities also offer low-cost weatherization and energy efficiency measures for Hard-to-Reach customers. Estimated funding for Hard-to-Reach programs in 2012 totaled $14.2 million.[10]

In addition to the above utility-administered programs, smaller utilities and municipal utilities offer low-income rate assistance programs. A few examples are below:

- El Paso Electric offers a Low Income Rider program where eligible low-income customers are exempt from the residential service customer charge.
- Reliant energy will not disconnect electricity service for critical-care customers, low-income elderly customers, and other low-income customers who agree to a payment plan.

Many utilities and coops also offer charitable rate assistance programs. Some examples are provided below:

- Several coops offer Operation Round Up programs where donations by members go toward community service projects, other community programs, and emergency assistance.
- Denton Municipal forwards customer donations to Interfaith Ministries, which distributes funds to families experiencing hardship in order to help with utility bill assistance.[11]

[10] LIHEAP Clearinghouse Texas State Snapshot, available at http://liheap.ncat.org/dereg/states/txsnapshot.htm, accessed June 5, 2014.
[11] LIHEAP Clearinghouse Texas Profile, available at http://liheap.ncat.org/profiles/Texas.htm#state, accessed June 5, 2014.

WASHINGTON

Summary

- **State ratemaking practices**
  - Equitable allocation of utility costs to customers
  - Low-income considerations
- **Collection of energy efficiency (and other) public benefit revenues**
  - In 2006, voters passed initiatives requiring that utilities meet certain renewable and efficiency standards, which utilities are allowed to fund through a customer surcharge
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 48% residential, 41% commercial, and 10% industrial
- **Protection of low-income customers**
  - Ratepayer-funded low-income programs totaled $47.5 million toward rate assistance and $6.4 million toward energy efficiency in 2010
  - Ratepayer-funded rate assistance and energy efficiency programs exist
  - State general funds are matched by utility funds for energy efficiency programs
  - Charitable rate assistance programs also exist
  - LIHEAP funding in 2014: $59,124,210

State ratemaking practices:

The Washington Utilities and Transportation Commission (Commission) is tasked with ensuring that rate increases proposed by utilities are reasonable to customers. In particular, whenever the Commission finds that rates are "unjust, unreasonable, unjustly discriminatory or unduly preferential," the Commission determines the just rates.[1] Furthermore, the Commission has the authority to approve discounted rates for low-income customers, and low-income senior customers.[2]

Collection of energy efficiency (and other) public benefit revenues:

In 2006, voters passed an initiative requiring utilities to meet certain targets related to energy efficiency and renewable energy, which utilities are allowed to recover through a customer surcharge. Utilities administer the specific programs, while the Transportation Commission provides oversight.[3]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Washington in 2012 was distributed in the following way: 48% of spending was on residential customers, 41% was on commercial customers, and 10% was on industrial customers.[4] This is in rough proportion to the electric revenues collected from each rate class.[5]

[1] RCW 80.28.020: Commission to fix just, reasonable, and compensatory rates.
[2] RCW 80.28.068: Low-income customers.
[3] "Public Benefits Funds: Increasing Renewable Energy & Industrial Energy Efficiency Opportunities," published by the US DOE, March 2010.

Protection of low-income customers:

LIHEAP provides federal funding to states to assist low-income utility customers with their home energy bills. For Washington, funding for 2014 totaled $59,124,210. Customers whose income is not greater than 125% of the Federal Poverty Level are LIHEAP-eligible. An estimated 71,592 households benefited from LIHEAP heat assistance in 2013, and heating benefits for 2013 ranged from $25 to $1,000, with an average of $450 spent per household served.[6]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of ratepayer funded low-income energy assistance and energy efficiency by state for certain states. The most recent data from 2010 lists a total of $47.5 million in ratepayer funds dedicated toward low-income rate assistance, and $6.4 million in ratepayer funds dedicated toward low-income energy efficiency.[7] These numbers include totals from state- and utility-administered programs.

As mentioned above, utilities are required to meet certain goals related to renewable energy and energy efficiency. In addition, utilities use ratepayer funds for low-income rate assistance. Examples of rate assistance programs for IOUs, Municipals/Co-ops, and Public Utility Districts (PUDs) are listed below:[8]

- Investor-Owned Utilities
    - Puget Sound Energy offers rate assistance to customers with incomes at or below 50% of the local median income. The benefit is calculated in relation to annual energy use.
    - PacifiCorp's Low-Income Bill Assistance program provides discounts to low-income customers that is applied to every kWh over 600 kWh of energy used. The discount varies based on household income and is available to customers with incomes at or below 100% the federal poverty guideline.
    - All five regulated IOUs provide rate assistance and/or discounts.
- Municipals/Cooperatives
    - The city of Richland offers a 33% discount on electric bills for low-income customers 62 years of age or older.
    - Seattle City Light offers a 60% discount on bills to customers with household incomes at or below 70% of the state median income.
- Public Utility Districts
    - The Low-Income Senior Discount is offered by 11 PUDs and provides discounts that range from 5 to 60% off on home energy bills for customers of at least 62 years of age that have household incomes at or below 125% of the federal poverty guideline (discounts and eligibility requirements vary based on PUD).

[4] Percentages reflect EE and Load Management Program costs from EIA data.
[5] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/, accessed June 9, 2014.
[6] LIHEAP Clearinghouse Washington Profile, available at http://liheap.ncat.org/profiles/WA.htm, accessed June 9, 2014.
[7] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm, accessed June 9, 2014.
[8] LIHEAP Clearinghouse Washington Snapshot, available at http://liheap.ncat.org/dereg/states/wasnapshot.htm, accessed June 9, 2014.

- The Low-Income Disabled Discount is offered by 8 PUDs and provides discounts that range from 5 to 40% off home energy bills for customers that meet disability and low-income requirements (discounts and income-eligibility requirements vary based on PUD)
- 12 PUDs offer some form of low-income discount.

Utilities also offer ratepayer-funded energy efficiency programs. As an example, Avista, PacifiCorp, and Puget Sound Energy have a Low-Income Weatherization program that provides insulation, installation of energy efficient appliances, and heating and cooling upgrades to low-income customers.[9] Many utilities also provide funds to the Energy Matchmaker Program, which matches state general funds and provides weatherization services to low-income households.[10]

Many utilities also offer charitable rate assistance programs that are funded through customer, employee, and/or community donations. These programs are often administered in conjunction with community action councils or entities like the Salvation Army.[11]

[9] LIHEAP Clearinghouse Washington Snapshot, available at http://liheap.ncat.org/dereg/states/wasnapshot.htm, accessed June 9, 2014.
[10] LIHEAP Clearinghouse Washington Profile, available at http://liheap.ncat.org/profiles/WA.htm, accessed June 9, 2014.
[11] LIHEAP Clearinghouse Washington Profile, available at http://liheap.ncat.org/profiles/WA.htm, accessed June 9, 2014.

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Summary

- **State ratemaking practices**
  - The Wisconsin Public Service Commission works to equitably allocate utility costs to rate classes
- **Collection of energy efficiency (and other) public benefit revenues**
  - The Commission has overseen the collection and spending of public benefit funding mechanisms for 15 years
- **Disbursement of energy efficiency revenues**
  - Energy efficiency revenues are spent in rough proportion to the dollars collected within rate classes
  - Energy efficiency spending in 2012 was 34% residential, 26% commercial, and 40% industrial
- **Protection of low-income customers**
  - Each electric IOU is required to spend 1.2% of the latest 3-year average of its gross operating revenue on energy efficiency and renewable energy programs
  - Ratepayer-funded low-income programs totaled $45.2 million toward rate assistance and $50 million toward energy efficiency in 2012
  - There are a number of emergency charitable assistance programs in place
  - LIHEAP funding in 2014: $103,103,118

State ratemaking practices:

The Wisconsin Public Service Commission (PSC) works to ensure that "in rate-making orders that an energy utility recovers from its ratepayers the amounts the energy utility spends for programs." In particular, the PSC works to equitably distribute recovery amounts between the different customer classes. The purpose being to "ensure that customers of an energy utility within a particular class are treated equitably with respect to customers of other energy utilities within the same class." [1]

State law requires that the Wisconsin PSC ensure that "the cost of energy efficiency and renewable resource programs is equitably divided among customer classes so that similarly situated ratepayers contribute equivalent amounts for the programs." [2]

Collection of energy efficiency (and other) public benefit revenues:

Wisconsin established a public benefit fund in 1999 that provided energy assistance programs for low-income residents in addition to funds for programs that promote renewable energy and energy efficiency. Today's program, known as Focus on Energy, became effective in July 2007 and replaced the public benefit programs in place at the time. Focus on Energy receives oversight and approval from the PSC, but programs and created and funded by the utilities. Furthermore, each electric IOU is required to spend

[1] Wisconsin State Legislature, Chapter 196, Regulation of Public Utilities, Section 374, (5) Cost Recovery.
[2] Wisconsin State Legislature, Chapter 196, Regulation of Public Utilities, Section 374, (5) Cost Recovery.

1.2% of the latest 3 year average of its gross operating revenue on renewable energy and energy efficiency programs.[3]

Wisconsin municipal utilities and electric cooperatives can also participate in "commitment-to-community" programs similar to Focus on Energy. These programs are not overseen by the PSC, but they do submit annual reports to the PSC.[4]

Disbursement of energy efficiency revenues:

According to the EIA, energy efficiency spending in Wisconsin in 2012 was distributed in the following way: 34% of spending was on residential customers, 26% was on commercial customers, and 40% was on industrial customers. This is in rough proportion to the electric revenues collected from each rate class.[5]

Protection of low-income customers:

LIHEAP provides states with federal funding to assist low-income utility customers with their home energy bills. For Wisconsin, funding for 2014 totaled $103 million. Customers whose income is not greater than 60% of the state median income are LIHEAP-eligible. An estimated 214,531 households benefited from LIHEAP heat assistance in 2013. As an example, LIHEAP benefits for 2013 included a minimum of $30 for heating, while the average and maximum were $336 and $2,085, respectively.[6]

The LIHEAP Clearinghouse compiles a table that provides the breakdown of Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency by state for certain states. The most recent data from 2012 lists a total of $45.2 million in ratepayer funds dedicated toward low-income rate assistance, and $50 million in ratepayer funds dedicated toward low-income energy efficiency. These funds served 212,816 households in rate assistance, and 7,196 in energy efficiency and weatherization assistance.[7]

These programs provide non-heating electric bill assistance based on a household's income, size, and electric costs. Energy efficiency funds include refrigerator replacements, insulation, upgrades to furnaces and lighting, and energy education. Participating utilities include We Energies, Alliant Energy, Xcel Energy, Madison Gas & Energy, Northwestern Electric, 15 electric cooperatives and 54 municipal utilities, among others.[8]

In addition to the above utility-administered programs, there are a number of emergency charitable assistance programs in Wisconsin. A few examples are below:[9]

- Wisconsin's Keep Wisconsin Warm/Cool Fund is a voluntary and community program that provides energy assistance to low income people. Business and individuals make contributions to the fund.

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[3] "Wisconsin Incentives/Policies for Renewables & Efficiency, Focus on Energy Program." Database for State Incentives for Renewables & Efficiency, DSIRE, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WI15R&re=1&ee=1, accessed June 10, 2014.
[4] "Wisconsin Incentives/Policies for Renewables & Efficiency, Focus on Energy Program." Database for State Incentives for Renewables & Efficiency, DSIRE, available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WI15R&re=1&ee=1, accessed June 10, 2014.
[5] Electric power sales, revenues, and energy efficiency Form EIA-861 detailed data files, U.S. Energy Information Administration, Electricity, available at http://www.eia.gov/electricity/data/eia861/.
[6] LIHEAP Clearinghouse Wisconsin Profile, available at http://liheap.ncat.org/profiles/Wisconsin.htm, accessed June 10, 2014.
[7] LIHEAP Clearinghouse "2012 State-by-State Ratepayer Funded Low-Income Energy Assistance and Energy Efficiency," available at http://liheap.ncat.org/Supplements/2012/supplement12.htm.
[8] LIHEAP Wisconsin Snapshot, available at http://liheap.ncat.org/dereg/states/wisnapshot.htm, accessed June 10, 2014.
[9] LIHEAP Clearinghouse Wisconsin Profile, available at http://liheap.ncat.org/profiles/Wisconsin.htm, accessed June 10, 2014.

- Menasha Utilities' Project Share Fund allows customers to donate monthly or annually to the fund which assists local families with energy bills.
- Helping Hand is run by River Falls Municipal Utilities and matches customers' payments on an account to help bring the account to a current status.

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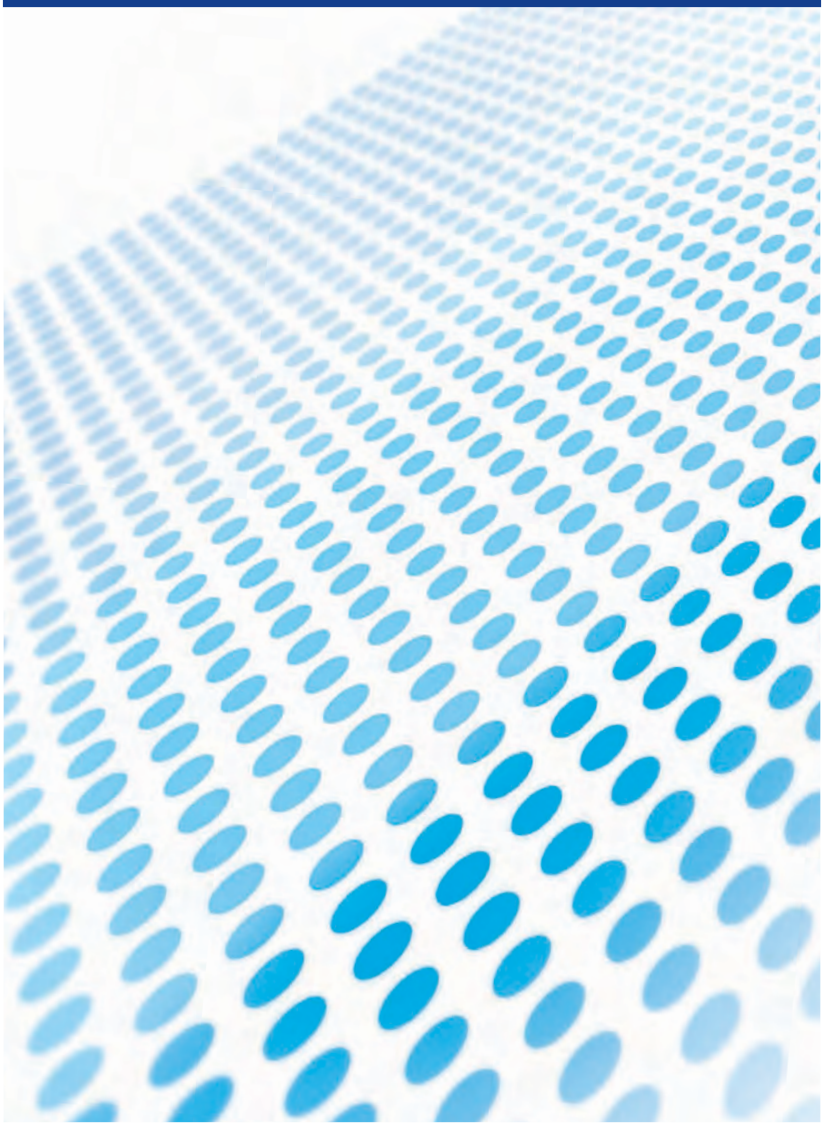

Contents

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IHS™ Energy

The Value of US Power Supply Diversity

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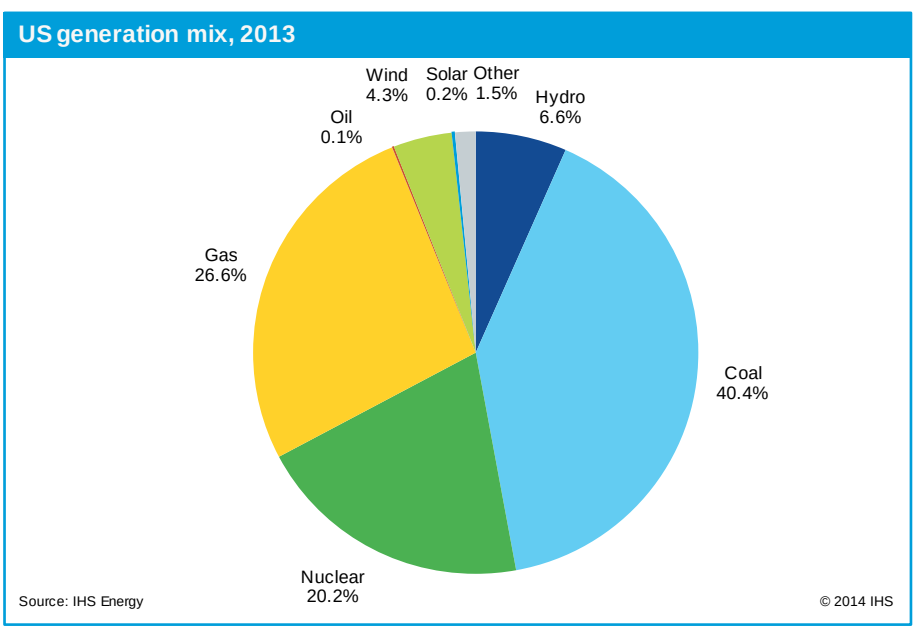
Executive summary

Engineering and economic analyses consistently show that an integration of different fuels and technologies produces the least-cost power production mix. Power production costs change because the input fuel costs—including for natural gas, oil, coal, and uranium—change over time. The inherent uncertainty around the future prices of these fuels translates into uncertainty regarding the cost to produce electricity, known as production cost risk. A diversified portfolio is the most cost-effective tool available to manage the inherent production cost risk involved in transforming primary energy fuels into electricity. In addition, a diverse power generation technology mix is essential to cost-effectively integrate intermittent renewable power resources into the power supply mix.

The current diversified portfolio of US power supply lowers the cost of generating electricity by more than $93 billion per year, and halves the potential variability of monthly power bills compared to a less diverse supply. Employing the diverse mix of fuels and technologies available today produces lower and less volatile power prices compared to a less diverse case with no meaningful contributions from coal and nuclear power and a smaller contribution from hydroelectric power (see Figure ES-1). In this less diverse scenario, called the *reduced diversity case,* wind and solar power make up one-third of installed capacity (up from about 7% in the base case) and 22.5% of generation; hydroelectric power capacity decreases from about 6.6% to 5.3% and represents 3.8% of generation; and natural gas–fired power plants account for the remaining 61.7% of installed capacity and 73.7% of generation.

FIGURE ES-1



Power supply in the reduced diversity case increases average wholesale power prices by about 75% and retail power prices by 25%. Energy production costs are a larger percentage of industrial power prices, and many industrial consumers buy power in the wholesale power market. Thus a loss of power supply diversity will disproportionally affect the industrial sector. These higher electricity prices impact the broader US economy by forcing economic

adjustments in production and consumption. If the US power sector moved from its current diverse generation mix to the less diverse generating mix, power price impacts would reduce US GDP by nearly $200 billion, lead to roughly one million fewer jobs, and reduce the typical household's annual disposable income by around $2,100. These negative economic impacts are similar to an economic downturn. Additional potential negative impacts arise from reducing power supply diversity by accelerating the retirement of existing power plants before it is economic to do so. For example, a transition to the reduced diversity case within one decade would divert around $730 billion of capital from more productive applications in the economy. The size of the economic impact from accelerating power plant turnover and reducing supply diversity depends on the deviation from the pace of change dictated by the underlying economics.

Maintaining and preserving a diverse US power supply mix is important to consumers for two reasons:

- Consumers reveal a strong preference for not paying more than they have to for reliable electricity.
- Consumers reveal preferences for some degree of predictability and stability in their monthly power bills.

The economic benefits of diverse power supply illustrate that the conventional wisdom of not putting all your eggs in one basket applies to power production in much the same way as it does to investing. This is the *portfolio effect*. In addition, diversity enables the flexibility to respond to dynamic fuel prices by substituting lower-cost resources for more expensive resources in the short run by adjusting the utilization of different types of generating capacity. This ability to move eggs from one basket to another to generate fuel cost savings is the *substitution effect*. Looking ahead, the portfolio and substitution effects remain critically important to managing fuel price risks because of the relative fuel price dynamics between coal and natural gas.

The shale gas revolution and restrictions on coal are driving an increased reliance on natural gas for power generation and provide strong economic benefits. However, this past winter demonstrated the danger of relying too heavily on any one fuel and that all fuels are subject to seasonal price fluctuations, price spikes, and deliverability and infrastructure constraints. The natural gas price spikes and deliverability challenges during the past winter were a jolt for a number of power systems that rely significantly on natural gas in the generation supply. These recent events demonstrated that natural gas deliverability remains a risk and natural gas prices continue to be hard to predict, prone to multiyear cycles, strongly seasonal, and capable of significant spikes. The root causes of these price dynamics are not going away anytime soon. The best available tool for managing uncertainty associated with any single fuel or technology is to maintain a diverse power supply portfolio.

Maintaining power supply diversity is widely supported—the idea of an all-of-the-above approach to the energy future is supported on both sides of the aisle in Congress and at both ends of Pennsylvania Avenue. Four decades of experience demonstrate the conclusion that government should not pick fuel or technology winners, but rather should create a level playing field to encourage the economic decisions that move the power sector toward the most cost-effective generation mix.

Maintaining a diverse power supply currently is threatened by three emerging trends:

- **Awareness.** The value of fuel diversity is often taken for granted because United States consumers inherited a diverse generation mix based on decisions from decades ago.

- **Energy policy misalignment.** Legislation and regulatory actions increasingly dictate or prohibit fuel and technology choices. The resulting power supply is increasingly at odds with the underlying engineering/economic principles of a cost-effective power supply mix.

- **Power market governance gridlock.** Market flaws produce wholesale power prices that are chronically too low to produce adequate cash flows to support and maintain investments in a cost-effective power generation mix. This "missing money" problem is not being addressed in a timely and effective way through the stakeholder governance processes found in most power markets. As a result, the loss of power supply diversity is accelerating because too many power plants are retiring before it is economic to do so. Consequently, they will be replaced with more costly sources of supply.

US power consumers are fortunate to have inherited a diverse power supply based on fuel and technology decisions made over past decades. Unfortunately, the current benefits of US power supply diversity are often taken for granted. This undervaluation of power supply diversity means there is no counterweight to current pressures moving the United States toward a future generation mix without any meaningful contribution from nuclear, coal, or oil and a diminished contribution from hydroelectric generation.[1]

The United States needs to consider the consequences of a reduced diversity case involving no meaningful contribution from nuclear, coal-fired, or oil-fueled power plants, and significantly less hydroelectric power. A reduced diversity case presents a plausible future scenario in which the power supply mix has intermittent renewable power generation capacity of 5.5% solar, 27.5% wind, and 5.3% hydro and the remaining 61.7% of capacity is natural gas–fired power plants. Comparing the performance of current US power systems to this possible reduced diversity case provides insights into the current nature and value of diversity in the US generation mix.

IHS Energy assessed the current value of fuel diversity by using data on the US power sector for the three most recent years with sufficient available data: 2010 through 2012. IHS Energy employed its proprietary Power System Razor (Razor) Model to create a base case by closely approximating the actual interactions between power demand and supply in US power systems. Following this base case, the Razor Model was employed to simulate the reduced diversity case over the same time period. The differences between the base case and the reduced diversity case provide an estimate of the impact of the current US power supply fuel and technology diversity on the level and variance of power prices in the United States. These power sector outcomes were fed through to the IHS US macroeconomic model to quantify the broader economic impacts of the resulting higher and more varied power prices along with the shifts in capital deployment associated with premature retirements that accelerate the move to the reduced diversity case.

The difference between the base case and the reduced diversity case is a conservative estimate of the value of fuel diversity. The portfolio and substitution values would be greater over a longer analysis time frame because uncertainty and variation in costs typically increase over a longer time horizon. In addition, the estimate is conservative because it excludes indirect feedback effects from a higher risk premium in the reduced diversity power supplier cost of capital. This feedback is not present because the analysis alters only the generation capacity mix and holds all else constant. This indirect cost feedback would increase capital costs in this capital-intensive industry and magnify the economic impact of current trends to replace power plants before it is economic to do so by moving shifting capital away from applications with better risk-adjusted returns.

The United States is at a critical juncture because in the next decade the need for power supply to meet increased customer demands, replace retiring power plants, and satisfy policy targets will require fuel and

1. Oil-fired power plants account for about 4% of US capacity and 0.2% of US generation but can play a critical role in providing additional electricity when the system is under stress.

technology decisions for at least 150 gigawatts (GW)—about 15% of the installed generating capacity in the United States. However, current trends in energy policy could push that power plant turnover percentage to as much as one-third of installed capacity by 2030. The implication is clear: power supply decisions made in the next 10–15 years will significantly shape the US generation mix for decades to come.

The results of this study indicate seven key factors that will shape US power supply diversity in the years to come:

- **Energy policy development.** US policy heavily influences the US power supply mix. Implementing an all-of-the-above energy policy requires properly internalizing the value of fuel diversity.

- **Market structure.** Market flaws distort wholesale power prices downward and result in uneconomic retirement and replacement of existing cost-effective generation resources. This issue and any market structure changes to address it will significantly shape future power plant development.

- **Energy policy discourse.** Preserving the value of fuel diversity depends on public awareness and understanding. The extent and nature of public education regarding the value of power supply diversity may strongly influence public opinion.

- **Planning alignment.** Alignment of fuel and technology choices for power generation with engineering and economic principles is critical to efficient and reliable supply. There is no single fuel or technology of choice for power generation, and all forms of power production have economic, environmental, and reliability impacts.

- **Risk assessment.** To incorporate system considerations into plant-level decisions, prudent fuel price uncertainties must be used with probabilistic approaches to decision making.

- **Flexibility.** Flexibility and exemptions in rule making and implementation allow for the balancing of costs and benefits in power supply systems and may help preserve highly valuable diversity in systemwide decisions as well as on a small but impactful individual plant scale.

- **Scope.** Including fuel price risk and additional storage and transportation infrastructure costs is crucial when evaluating reduced diversity scenarios in comparison to the cost of maintaining and expanding fuel diversity.

The Value of US Power Supply Diversity

Overview

The power business is customer driven: consumers do not want to pay more than necessary for reliable power supply, and they want some stability and predictability in their monthly power bills. Giving consumers what they want requires employing a diverse mix of fuels and technologies in power production. Employing the diverse mix of fuels and technologies available today produces lower and less volatile power prices compared to a less diverse case with no meaningful contributions from coal and nuclear power and a smaller contribution from hydroelectric power. In this less diverse scenario, called the *reduced diversity case,* wind and solar power make up one-third of installed capacity (up from about 7% in the base case) and 22.5% of generation; hydroelectric power capacity decreases from about 6.6% to 5.3% and represents 3.8% of generation; and natural gas–fired power plants account for the remaining 61.7% of installed capacity and 73.7% of generation.

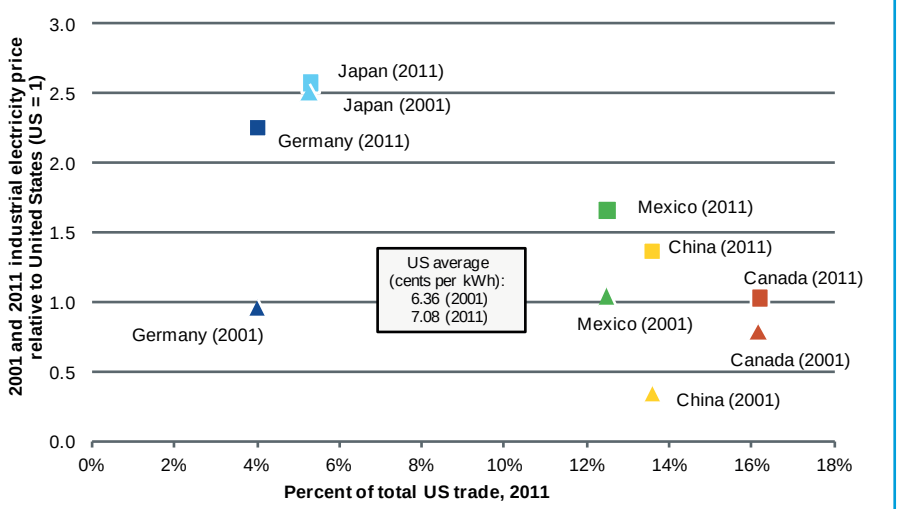
The current diverse US power supply reduces US consumer power bills by over $93 billion per year compared to a reduced diversity case. In addition, the current diversified power generation mix mitigates exposure to the price fluctuations of any single fuel and, by doing so, cuts the potential variability of monthly power bills roughly in half.

Power prices influence overall economic performance. For example, since the recovery of the US economy began in the middle of 2009, manufacturing jobs in the 15 states with the lowest power prices increased by 3.3%, while in the 15 states with the highest power prices these jobs declined by 3.2%. This job impact affected the overall economic recovery. The average annual economic growth in the 15 states with the lowest industrial power prices was 0.6 percentage points higher than in the 15 states with the highest power prices.

Higher and more varied power prices can also impact international trade. In the past decade, the competitive position for US manufacturers improved thanks to lower relative energy costs, including the improving US relative price of electric power (see Figure 1). Although power prices are only one of a number of factors that influence competitive positions in the global economy, there are clear examples, such as Germany, where moving away from a cost-effective power generating mix is resulting in significant economic costs and a looming loss of competitiveness. German power prices increased rapidly over the past decade because Germany closed nuclear power plants before it was economic to do so and added too many wind and solar power resources too quickly into the generation mix. IHS estimates that Germany's net export losses

FIGURE 1

Relative industrial electricity prices for top five US trading partners



Note: Total trade = exports plus imports.
Source: IHS Energy, US Census Bureau, OECD/IEA

directly attributed to the electricity price differential totaled €52 billion for the six-year period from 2008 to 2013.[2]

A less diverse US power supply would make power prices higher and more varied and force a costly adjustment process for US consumers and businesses. The price increase associated with the reduced diversity case produces a serious setback to US economic activity. The value of goods and services would drop by nearly $200 billion, approximately one million fewer jobs would be supported by the US economy, and the typical household's annual disposable income would go down by over $2,100. These economic impacts take a few years to work through the economy as consumers and producers adjust to higher power prices. The eventual economic impacts are greater if current trends force the closure and replacement of power plants before it is economic to do so. Regardless of the replacement technology, it is uneconomic to close a power plant when the costs of continued operation are less than the cost of a required replacement. Premature power plant turnover imposes an additional cost burden by shifting capital away from more productive applications. A closure and replacement of all nuclear and coal-fired generating capacity in the next 10 years would involve roughly $730 billion of investment. An opportunity cost exists in deploying capital to replace productive capital rather than expanding the productive capital base.

The United States currently faces a key challenge in that many stakeholders take the current benefits of power supply diversity for granted because they inherited diversity based on fuel and technology decisions made decades ago. There is no real opposition to the idea of an all-of-the-above energy policy in power supply. Yet, a combination of factors—tightening environmental regulations, depressed wholesale power prices, and unpopular opinions of coal, oil, nuclear, and hydroelectric power plants—are currently moving the United States down a path toward a significant reduction in power supply diversity. A lack of understanding of power supply diversity means momentum will continue to move the United States toward a future generation mix without any meaningful contribution from nuclear, coal, or oil, and a diminishing contribution from hydroelectric generation.

The United States is at a critical juncture because power plant fuel and technology decisions being made today will affect the US power supply mix for decades to come. These decisions need to be grounded in engineering, economic, and risk management principles that underpin a cost-effective electric power sector. Comparing the performance of the current generation mix to results of the reduced diversity case provides key insights into the current nature and value of diversity. An assessment and quantification of the value of power supply diversity will help achieve a more cost-effective evolution of US power supply in the years ahead.

Generation diversity: A cornerstone of cost-effective power supply

If power consumers are to receive the reliable and cost-effective power supply they want, then cost-effective power production requires an alignment of power supply to power demand. Engineering, economic, and risk management assessments consistently show that an integration of fuels and technologies produces the least-cost power production mix. A cost-effective mix involves integrating nondispatchable power supply with dispatchable base-load, cycling, and peaking technologies. This cost-effective generating mix sets the metrics for cost-effective demand-side management too. Integrating cost-effective power demand management capabilities with supply options requires balancing the costs of reducing or shifting power demand with the incremental cost of increasing power supply. Appendix A reviews the principles of engineering, economics, and risk management that lead to the conclusion that cost-effective power supply requires fuel and technological diversity.

2. See the IHS study *A More Competitive Energiewende: Securing Germany's Global Competitiveness in a New Energy World*, March 2014.

The underlying principles of cost-effective power supply produce five key insights:

- There is no single fuel or technology of choice for power generation. Reliably and efficiently supplying consumers with the amounts of electricity they want when they want it requires a diverse generation mix.
- A cost-effective generation mix involves diversity but does not involve maximizing diversity by equalizing generation shares from all available supply options.
- A cost-effective mix of fuel and technologies for any power system is sensitive to the uncertainties surrounding the level and pattern of consumer power demands as well as the cost and performance of alternative power generating technologies and, in particular, the delivered fuel prices.
- A cost-effective generating mix will differ from one power system to the next because of differences in aggregate consumer demand patterns as well as in the cost and performance of available generating options.
- The best type of capacity to add to any generation portfolio depends on what types of capacity are already in the mix.

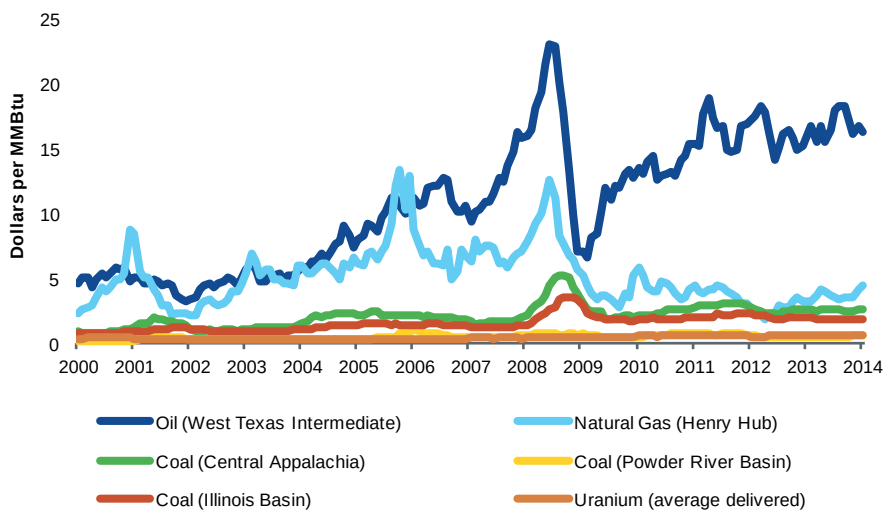
Power production cost fluctuations reflect inherent fuel price uncertainties

Power consumers reveal preferences for some degree of predictability and stability in their monthly power bills. These consumer preferences present a challenge on the power supply side because the costs of transforming primary energy—including natural gas, oil, coal, and uranium—into electric power is inherently risky. Experience shows that the prices of these fuel inputs to the power sector are difficult to anticipate because these prices move in multiyear cycles and fluctuate seasonally (see Figure 2). In addition, this past winter showed that dramatic price spikes occur when natural gas delivery systems are pushed to capacity (see Figure 3).

The recent volatility in the delivered price of natural gas to the US Northeast power systems demonstrates the value of fuel diversity. During this past winter, colder-than-normal weather created greater consumer demand for natural gas and electricity to heat homes and businesses. The combined impact on natural gas demand strained the capability of pipeline systems to deliver natural gas in the desired quantity and pressure. Natural gas prices soared, reflecting the market forces allocating available gas to the highest valued end uses. At some points in time, price allocation was

FIGURE 2

Monthly spot oil, natural gas, and coal prices, 2000–14 year to date



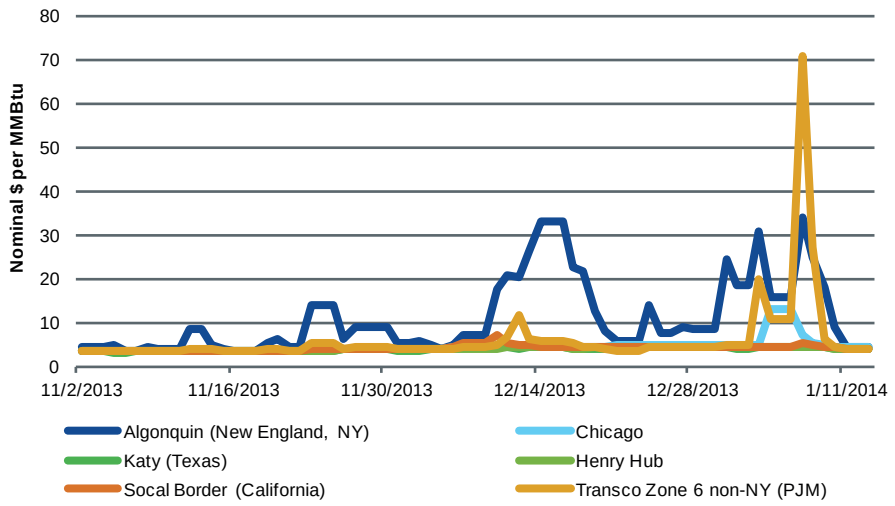
Source: IHS Energy
Data Sources: Energy Information Administration, Platt's and Natural Gas Intelligence, Platts Coal Outlook, SNL Energy Coal

not enough and additional natural gas was not available at any price, even to power plants holding firm supply contracts.

As high as the natural gas price spikes reached, and as severe as the natural gas deliverability constraints were, things could have been worse. Although oil-fired power provided only 0.35% of generation in the Northeast in 2012, this slice of power supply diversity provided an important natural gas supply system relief valve. The oil-fired power plants and the dual-fueled oil- and natural gas–fired power plants were able to use liquid fuels to generate 12% of the New England power supply during the seven days starting 22 January 2014 (see Figure 4). This oil-fired generation offset the equivalent of 327,000 megawatt-hours (MWh) of natural gas–fired generation and thus relieved the natural gas delivery system of about 140 million cubic feet per day of natural gas deliveries. This fuel diversity provided the equivalent to a 6% expansion of the daily delivery capability of the existing natural gas pipeline system.

FIGURE 3

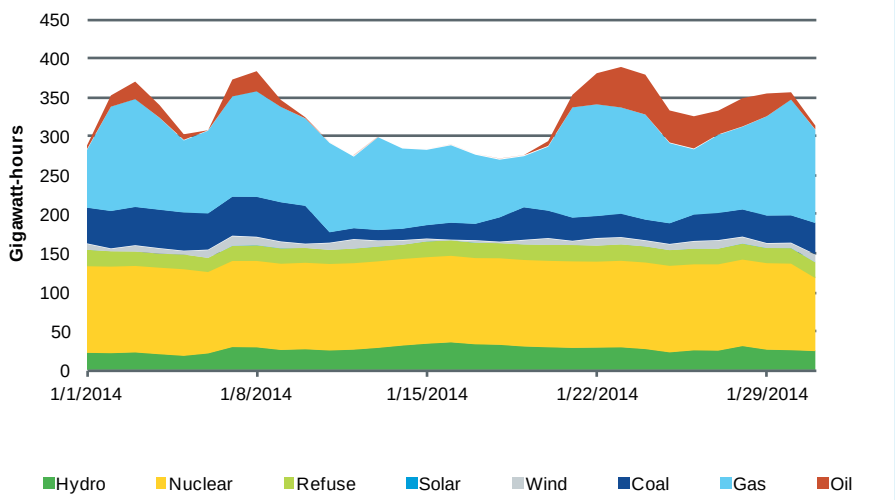
Delivered daily gas prices, November 2013–January 2014



Source: IHS Energy, Ventyx Velocity Suite

FIGURE 4

ISO New England generation, January 2014



Source: IHS Energy

The lesson from this past winter was that a small amount of oil-fired generation in the supply mix proved to be highly valuable to the Northeast energy sector despite its production costs and emission rates. Many of these oil-fired power plants are old and relatively inefficient at converting liquid fuel to power. However, this relative inefficiency does not impose a great penalty because these power plants need to run very infrequently to provide a safety valve to natural gas deliverability. Similarly, these units have emissions rates well above those achievable with the best available technology, but the absolute amount of emissions and environmental impacts are small because their utilization rates are so low. Although the going forward costs and the environmental impacts are relatively small, the continued operation of these oil-fired power plants is at risk from tightening environmental regulations.

Oil-fired power plants were not the only alternative to natural gas–fired generation this past winter. Coal played a major role. As the *New York Times* reported on 10 March 2014, 89% of American Electric Power Company, Inc.'s 5,573 megawatts (MW) of coal-fired power plants slated for retirement in 2015 owing to tightening environmental regulations were needed to keep the lights on during the cold snap this past winter in PJM.[3]

The critical role fuel diversity played during the recent polar vortex affected power systems that serve over 40 million US electric consumers and almost one-third of power supply. This widespread exposure to natural gas price and deliverability risks is becoming increasingly important because the share of natural gas in the US power mix continues to expand. The natural gas–fired share of power generation increased from 16% to 27% between 2000 and 2013. Twelve years ago, natural gas–fired generating capacity surpassed coal-fired capacity to represent the largest fuel share in the US installed generating mix. Currently, natural gas–fired power plants account for 40% of the US installed capacity mix.

The increasing dependence on natural gas for power generation is not an accident. The innovation of shale gas that began over a decade ago made this fuel more abundant and lowered both its actual and expected price. But the development of shale gas did not change the factors that make natural gas prices cyclical, volatile, and hard to forecast accurately.

Factors driving natural gas price dynamics include

- Recognition and adjustment lags to market conditions
- Over- and under-reactions to market developments
- Linkages to global markets through possible future liquefied natural gas (LNG) trade
- Misalignments and lags between natural gas demand trends, supply expansions, and pipeline investments
- "Black swan" events—infrequent but high-impact events such as the polar vortex

Natural gas price movements in the shale gas era illustrate the impact of recognition and adjustment lags to changing market conditions. Looking back, natural gas industry observers were slow to recognize the full commercialization potential and magnitude of the impact that shale gas would have on US natural gas supply. Although well stimulation technologies date back to the 1940s, today's shale gas technologies essentially began with the innovative efforts of George Mitchell in the Barnett resource base near Fort Worth, Texas, during the 1980s and 1990s. Mitchell Energy continued to experiment and innovate until eventually proving the economic viability of shale gas development. As a result, shale gas production expanded (see Figure 5).

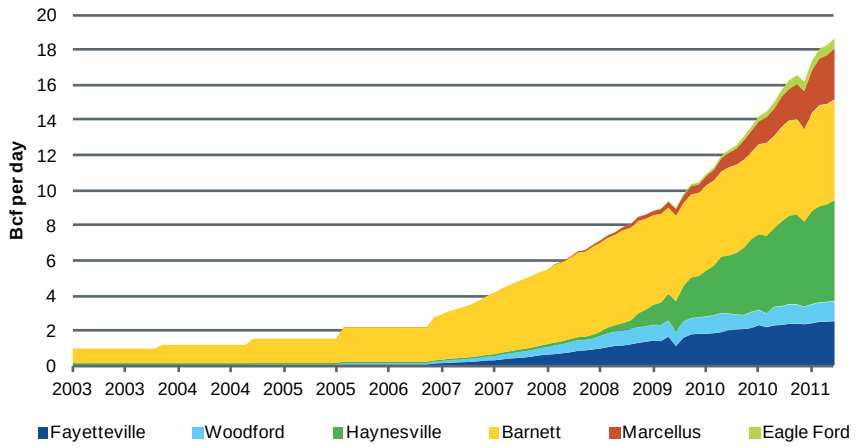
Although shale gas had moved from its innovation phase to its commercialization phase, many in the oil and gas industry did not fully recognize what was happening even as US shale gas output doubled from 2002 to 2007 to reach 8% of US natural gas production. The belief that the United States was running out of natural gas persisted, and this recognition lag supported the continued investment of billions of dollars to expand LNG import facilities (see Figure 6).

3. *New York Times.* "Coal to the Rescue, But Maybe Not Next Winter." Wald, Matthew L. 10 March 2014: http://www.nytimes.com/2014/03/11/business/energy-environment/coal-to-the-rescue-this-time.html?_r=0, retrieved 12 May 2014.

Eventually, evidence of a shale gas revolution became undeniable. However, recognition and adaptation lags continued. Productivity trends in natural gas–directed drilling rigs indicate that only about 400 gas-directed rigs are needed to keep natural gas demand and supply in balance over the long run. Yet operators in the natural gas industry did not fully anticipate this technological trend. Bullish price projections caused the US natural gas–directed rig count to rise from 690 to 1,600 rigs

FIGURE 5

Growth in major US shale plays



Note: Bcf = billion cubic feet.
Source: IHS Energy, Lippmann Consulting

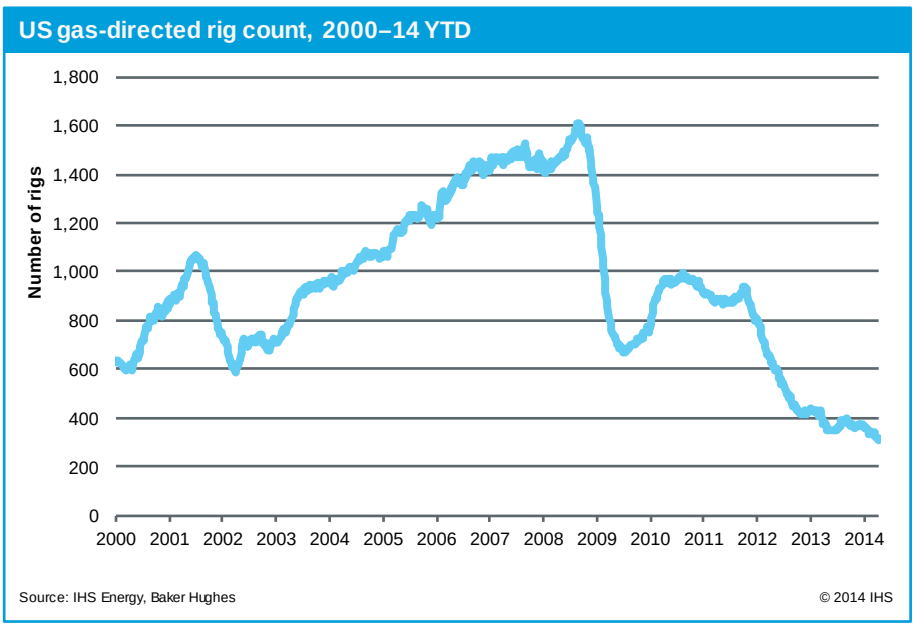
FIGURE 6

LNG facilities in North America—Existing and proposed (October 2006)

40609-1Source: IHS Energy

between 2002 and 2008. This level of drilling activity created a supply surplus that caused a precipitous decline of up to 85% in the Henry Hub natural gas price from 2008 to 2012. From the 2008 high count, the number of US natural gas–directed rigs dropped over fivefold to 310 by April 2014 (see Figure 7).

FIGURE 7



Natural gas investment activity also lagged market developments. During this time, the linkage between North American natural gas markets and global markets reversed from an investment hypothesis supporting an expansion of LNG *import* facilities, as shown in Figure 6, to an investment hypothesis involving the expansion of LNG *export* facilities (see Figure 8). At the same time, investment in natural gas pipelines and storage did not keep pace with the shifts in domestic demand, supply, and trade. This asymmetry created vulnerability to low frequency but high impact events, such as colder-than-normal winters that expose gas deliverability constraints and launch record-setting delivered price spikes, as happened in the Northeast in the winters of 2012/13 and 2013/14.

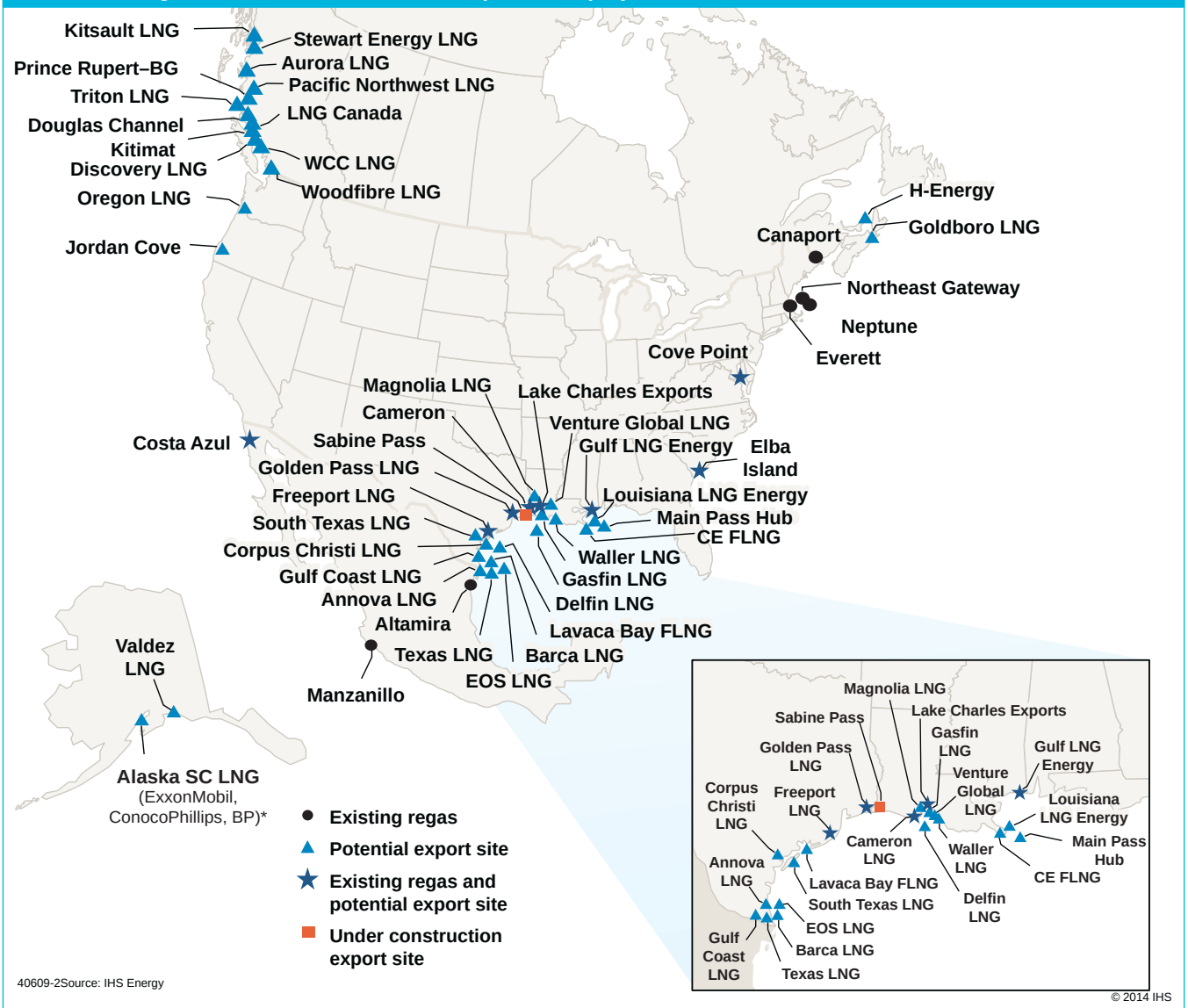
The Northeast delivered natural gas price spikes translated directly into dramatic power production cost run-ups. During the winter of 2013/14, natural gas prices delivered to the New York and PJM power system border hit $140 per MMBtu (at Transco Zone 6, 21 January 2014) and pushed natural gas–fired power production costs up 25-fold from typical levels and well beyond the $1,000 per MWh hourly wholesale power price cap in New York and PJM. This forced the New York Independent System Operator (NYISO) to allow exemptions to market price caps. The Federal Energy Regulatory Commission granted an emergency request to lift wholesale power price caps in PJM and New York. Lifting these price caps kept the lights on but also produced price shocks to 30% of the US power sector receiving monthly power bills in these power systems. The impact moved the 12-month electricity price index (a component of the consumer price index) in the Northeast up 12.7%—the largest 12-month jump in eight years.

The New York Mercantile Exchange (NYMEX) futures contract price strip illustrates how difficult it is to anticipate natural gas price movements. Figure 9 shows the price dynamics over the shale gas era and periodic examples of the NYMEX futures price expectations. The NYMEX future price error pattern indicates a bias toward expecting future natural gas prices to look like those of the recent past. Although these futures prices are often used as an indicator of future natural gas price movements, they have nonetheless proven to be a poor predictor.

The complex drivers of natural gas price dynamics continue to apply in the shale gas era. Prudent planning requires recognition that natural gas price movements remain hard to forecast, affected by multiyear

FIGURE 8

US lower-48 regasification facilities and filed liquefaction projects



40609-2Source: IHS Energy

investment cycles that lag market developments, subject to seasonality, and capable of severe short-run price volatility.

Natural gas price cycles during the shale gas era and the recent extreme volatility in natural gas prices are clear evidence that the benefits of increased natural gas use for power generation need to be balanced against the costs of natural gas's less predictable and more variable production costs and fuel availability.

The natural gas–fired generation share is second only to the coal-fired generation share. One of the primary reasons that fuel diversity is so valuable is because natural gas prices and coal prices do not move together.

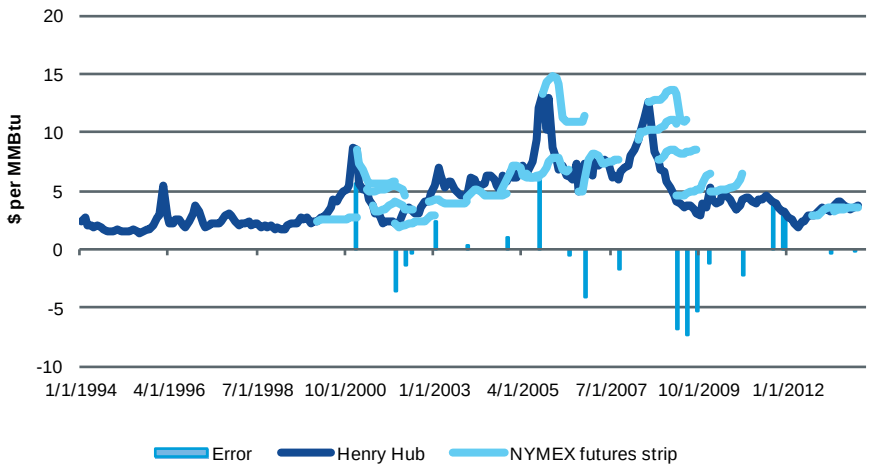
Significant variation exists in the price of natural gas relative to the price of coal delivered to US power generators (see Figure 10). The dynamics of the relative price of natural gas to coal are important because

relative prices routinely change which power plants provide the most cost-effective source of additional power supply at any point in time.

The relative prices of natural gas to coal prior to the shale gas revolution did not trigger as much cost savings from fuel substitution as the current relative prices do. From 2003 to 2007 the price of natural gas was four times higher than the price of coal on a Btu basis. Under these relative price conditions, small changes in fuel prices did not alter the position of coal-fired generation as the lower-cost resource for power generation. The shale gas revolution brought gas prices to a more competitive level and changed the traditional relative relationship between gas and coal generation. As Table 1 shows, the 2013 dispatch cost to produce electricity at the typical US natural gas–fired power plant was equivalent to the dispatch cost at the typical US coal-fired power plant with a delivered natural gas price of $3.35 per MMBtu, about 1.39 times the delivered price of coal. Current price changes move the relative price of natural gas to coal around this average equivalency level and create more generation substitution than has historically occurred.

FIGURE 9

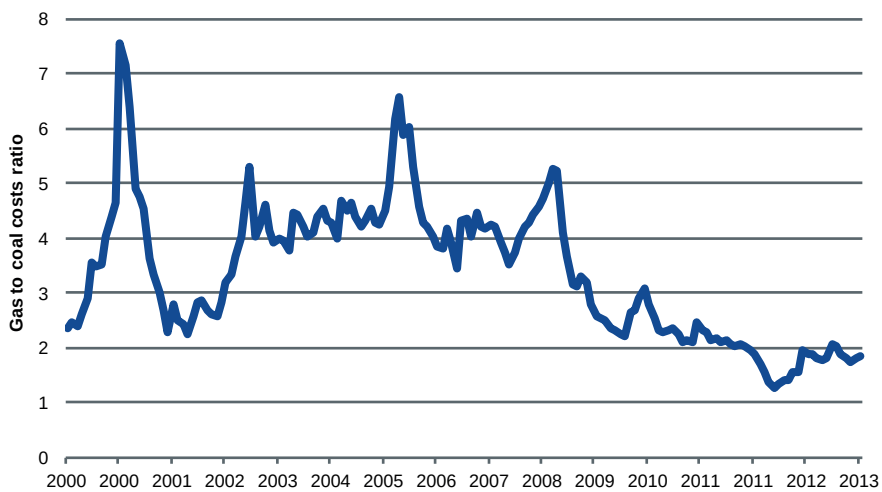
Henry Hub and NYMEX futures, 1994–2013



Source: IHS Energy

FIGURE 10

Ratio of delivered gas to delivered coal costs, 2000–13



Note: ratio of costs per MMBtu.
Source: IHS Energy, Ventyx Velocity Suite

The average equivalency level triggers cost savings from substitution within the generation mix. Current relative prices frequently move above and below this critical relative price level. Consequently, slight movements in either coal or natural gas prices can have a big impact on which generation resource provides the most cost-effective source of generation at any given point in time.

Coal price dynamics differ from natural gas price movements. The drivers of coal price dynamics include rail and waterborne price shifts, changes in coal inventory levels, and mine closures and openings. In addition, international coal trade significantly influences some coal prices. For example, when gas prices

began to fall in 2008–12, the natural gas displacement of coal in power generation caused Appalachian coal prices also to drop. However, the coal price drop was slower and less severe than the concurrent natural gas price drop because of the offsetting increase in demand for coal exports, particularly for metallurgical coal. Linkages to global coal market prices were significant even though only about one-quarter of Appalachian coal production was involved in international trade. The implication is that as global trade expands, the influence of international trade on domestic fuel prices may strengthen.

TABLE 1

Typical generating units

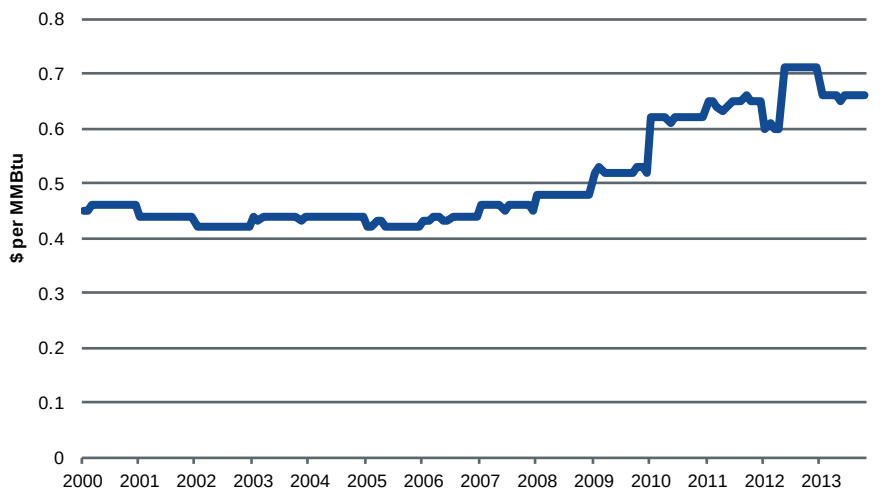
	Typical coal unit	Typical CCGT unit
Size, MW	218	348
Heat rate, Btu/kWh	10,552	7,599
Fuel cost, $/MMBtu	$2.41	$4.46
Fuel cost, $/MWh	$25.43	$33.89
Variable O&M, $/MWh	$4.70	$3.50
Lbs SO_2/MWh (with wet FGD)	1.16	0
SO_2 allowance price, $/ton	70	70
Lbs NO_X/MWh	0.74	0.15
NO_X allowance price, $/ton	252	252
SO_2,NO_X emissions cost, $/MWh	0.13	0.02
Short-run marginal cost, $/MWh	$30.26	$37.41
Breakeven fuel price, $/MMBtu	$2.41	$3.35

Note: kWh = kilowatt-hour(s); O&M = operation and maintenance (costs); SO_2 = sulfur dioxide; NO_X = nitrogen oxides; CCGT = combined-cycle gas turbine.

Source: IHS Energy

FIGURE 11

Nuclear fuel prices, 2000–13



Source: IHS Energy, Ventyx Velocity Suite

Nuclear fuel prices are also dynamic, and are different from fossil fuel prices in two ways (see Figure 11). Nuclear fuel cost is a relatively smaller portion of a nuclear plant's overall cost per kilowatt-hour. Also nuclear fuel prices have a different set of drivers. The primary drivers of nuclear fuel price movements include uranium prices, enrichment costs, and geopolitical changes in nuclear trade. These drivers produce price dynamics dissimilar to those of either natural gas or coal. As a result, nuclear fuel price movements are not strongly correlated to fossil fuel price movements.

Diversity: The portfolio effect

A diverse fuel and technology portfolio is a cornerstone for an effective power production risk management strategy. If prices for alternative fuels moved together, there would be little value in diversity. But relative power production costs from alternative fuels or technologies are unrelated and inherently unstable. As a result, the portfolio effect in power generation exists because fuel prices do not move together, and thus changes in one fuel price can offset changes in another. The portfolio effect of power generation fuel diversity is significant because the movements of fuel prices are so out of sync with one another.

The "correlation coefficient" is a statistical measure of the degree to which fuel price changes are related to each other. A correlation coefficient close to zero indicates no similarity in price movements. Correlation coefficients above 0.5 are considered strong correlations, and values above 0.9 are considered very strong correlations. Power production input fuel price changes (natural gas, coal, and nuclear) are not highly correlated and consequently create the basis for a portfolio approach to fuel price risk management (see Table 2).

TABLE 2

Delivered monthly fuel price correlations, 2000–13

Coal/natural gas	0.01
Natural gas/nuclear	(0.35)
Coal/nuclear	0.85

Source: IHS Energy

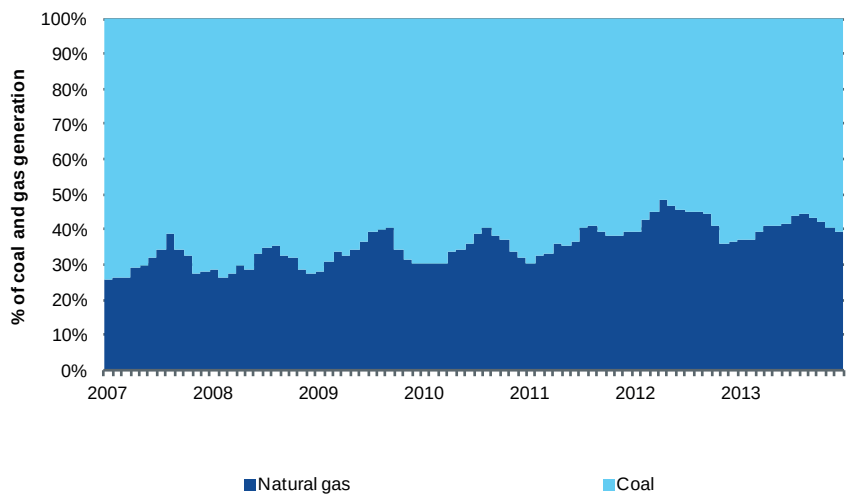
Diversity: The substitution effect

A varied portfolio mitigates power production cost risk because fuel diversity provides the flexibility to substitute one source of power for another in response to relative fuel price changes. Therefore, being able to substitute between alternative generation resources reduces the overall variation in production costs.

Substitution benefits have proven to be substantial. In the past five years, monthly generation shares for natural gas–fired generation were as high as 33% and as low as 19%. Similarly, monthly generation shares for coal-fired generation were as high as 50% and as low as 34%. The swings were driven primarily by a cost-effective alignment of fuels and technologies to consumer demand patterns and alterations of capacity utilization rates in response to changing relative fuel costs. Generation shares shifted toward natural gas–fired generation when relative prices favored natural gas and shifted toward coal-fired generation when relative prices favored coal. Figure 12 shows the recent flexibility in the utilization share tradeoffs between only coal-fired and natural gas–fired generation in the United States.

FIGURE 12

Coal and natural gas generation, 2007–13



Source: IHS Energy

Diversity benefits differ by technology

All types of generating fuels and technologies can provide the first dimension of risk management—the *portfolio effect*. However, only some types of fuels and technologies can provide the second dimension of risk management—the *substitution effect*. Power plants need to be dispatchable to provide the substitution

effect in a diverse portfolio. As a result, the benefits of expanding installed capacity diversity by adding nondispatchable resources such as wind and solar generating technologies are less than the equivalent expansion of power capacity diversity with dispatchable power plants such as biomass, conventional fossil-fueled power plants, reservoir hydro, and nuclear power plants. Therefore, not all diversity in the capacity mix provides equal benefits.

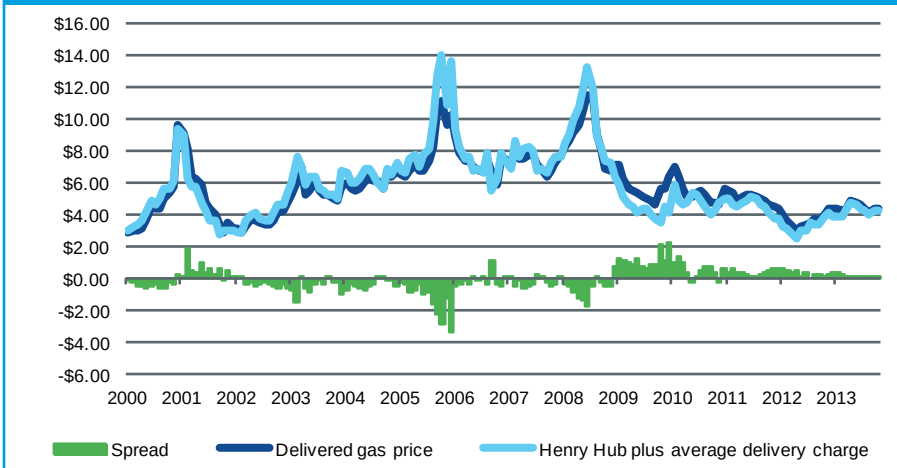
Diversity is the best available power cost risk management tool

A diverse portfolio is the best available tool for power generation cost risk management. Other risk management tools such as fuel contracts and financial derivatives complement fuel and technological diversity in power generation but fall far short of providing a cost-effective substitute for power supply diversity.

Contracts are tools available to manage power production cost risk. These tools include short-run contracts, including NYMEX futures contracts, as well as long-term contracts spanning a decade or more. Power generators have traditionally covered some portion of fuel needs with contracts to reduce the variance of delivered fuel costs. To do this, generators balance the benefits of using contracts or financial derivatives against the costs. With such assessment, only a small percentage of natural gas purchases are under long-term contracts or hedged in the futures markets. Consequently, the natural gas futures market is only liquid (has many buyers and sellers) for a few years out.

FIGURE 13

Power generation delivered gas price versus Henry Hub (plus delivery), 2000–13



Source: IHS Energy, Ventyx Velocity Suite

The degree of risk management provided by contracts is observed in the difference between the reported delivered price of natural gas to power generators and the spot market price plus a typical delivery change. Contract prices along with spot purchases combine to determine the reported delivered price of natural gas to power generators. Delivered prices are typically about 12% higher than the Henry Hub spot price owing to transport, storage, and distribution costs, so this percentage may be used to approximate a delivery charge. Figure 13 compares the Henry Hub spot price plus this typical delivery charge to the reported delivered price of natural gas to power producers.

A comparison of the realized delivered price to the spot price plus a delivery charge shows the impact of contracting on the delivered price pattern. Natural gas contracts provided some protection from spot price highs and thus reduced some variation of natural gas prices compared to the spot market price plus transportation. Over the past 10 years, contracting reduced the monthly variation (the standard deviation) in the delivered price of natural gas to the power sector by 24% compared to the variation in the spot price

plus delivery charges at the Henry Hub. Although fuel contracts are part of a cost-effective risk management strategy, the cost/benefit trade-offs of using contracts limit the application of these tools in a cost-effective risk management strategy.

Using a contract to lock into volumes at fixed or indexed prices involves risks and costs. Contracting for fuel creates volume risk. A buyer of a contract is taking on an obligation to purchase a given amount of fuel, at a given price, and at a future point in time. From a power generator's perspective, the variations in aggregate power consumer demand and relative prices to alternative generating sources make predicting the amount of fuel needed at any future point in time difficult. This difficulty increases the further out in time the contracted fuel delivery date. If a buyer ends up with too much or too little fuel at a future point in time, then the buyer must sell or buy at the spot market price at that time.

Contracting for fuel creates price risk. A buyer of a fuel contract locks into a price at a future point in time. When the contract delivery date arrives, the spot market price for the fuel likely differs from the contract price. If the contract price ends up higher than the spot market price, then the contract provided price certainty but also created a fuel cost that turned out to be more expensive than the alternative of spot market purchases. Conversely, if the spot market price turns out to be above the contract price, then the buyer has realized a fuel cost savings.

Past price relationships also illustrate the potential for gains and losses from contracting for natural gas in an uncertain price environment. When the spot market price at Henry Hub increased faster than expected, volumes contracted at the previously lower expected price produced a gain. For example, in June 2008 the delivered cost of natural gas was below that of the spot market. Conversely, when natural gas prices fell faster than anticipated, volumes contracted at the previously higher expected price produced a loss. For example in June 2012, the delivered cost of natural gas was above that of the spot market purchases.

The combination of volume and price risk in fuel contracting makes buying fuel under contract a speculative activity, capable of generating gains and losses depending on how closely contract prices align with spot market prices. Therefore, cost-effective risk management requires power generators to balance the benefits of gains from contracting for fuel volumes and prices against the risk of losses.

Managing fuel price risk through contracts does not always involve the physical delivery of the fuel. In particular, a futures contract is typically settled before physical delivery takes place, and thus is referred to as a financial rather than a physical hedge to fuel price uncertainty. For example, NYMEX provides a standard contract for buyers and sellers to transact for set amounts of natural gas capable of being delivered at one of many liquid trading hubs at a certain price and a certain date in the future. Since the value of a futures contract depends on the expected future price in the spot market, these futures contracts are derivatives of the physical natural gas spot market.

The potential losses facing a fuel buyer that employs financial derivatives create a risk management cost. Sellers require that buyers set aside funds as collateral to insure that potential losses can be covered. Market regulators want these guarantees in place as well in order to manage the stability of the marketplace. Recently, as part of reforms aimed at improving the stability of the financial derivatives markets, the Dodd-Frank Act increased these collateral requirements and thus the cost of employing financial derivatives.

Outside of financial derivatives, fuel deliverability is an important consideration in evaluating power cost risk management. Currently, natural gas pipeline expansion requires long-term contracts to finance projects. Looking ahead, the fastest growing segment of US natural gas demand is the power sector and, as described earlier, this sector infrequently enters into long-term natural gas supply contracts that would finance new pipelines. Consequently, pipeline expansions are not likely to stay in sync with power generation natural gas demand trends.

The prospect of continued periodic misalignments between natural gas deliverability and natural gas demand makes price spikes a likely feature of the future power business landscape. The nominal volume of long-term fuel contracts and the costs and benefits of entering into such contracts limit the cost-effective substitution of contracts for portfolio diversity. Therefore, maintaining or expanding fuel diversity remains a competitive alternative to natural gas infrastructure expansion.

Striking a balance between the costs and benefits of fuel contracting makes this risk management tool an important complement to a diverse generation portfolio but does not indicate that it could provide a cost-effective substitute for power supply diversity.

A starting point taken for granted

US power consumers benefit from the diverse power supply mix shown in Figure 14. Simply inheriting this diverse generation mix based on fuel and technology decisions made decades ago makes it easy for current power stakeholders to take the benefits for granted. This underappreciation of power supply diversity creates an energy policy challenge because if the value of fuel and technology diversity continues to be taken for granted, then the current political and regulatory process is not likely to properly take it into account when crafting legislation or setting regulations.

FIGURE 14

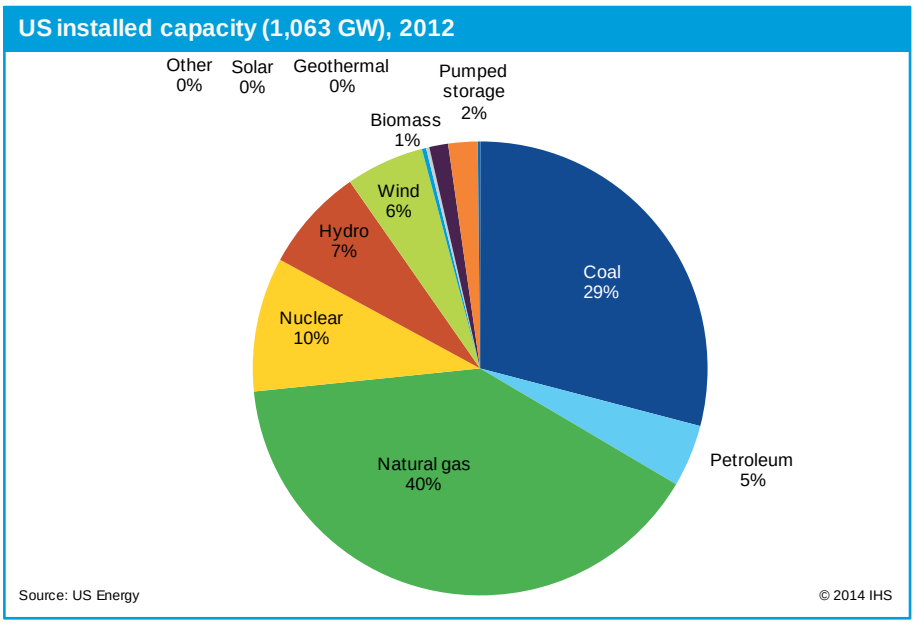


TABLE 3

The impact of fuel diversity: Power production fuel costs
(Actual versus all gas generation mix, 2000–13 YTD, cents per kWh)

	Henry Hub	All power sector fuel costs
Average	5.09	2.29
Maximum	11.02	4.20
Minimum	2.46	1.21
Standard deviation	1.63	0.55

Note: Converted the Henry Hub dollar per MMBtu price to cents per kWh using the average reported heat rate for all operating natural gas plants in the respective month.
Data source: Ventyx Velocity Suite.

Source: IHS Energy

As a result, the United States may move down a path toward a less diverse power supply without consumers realizing the value of power supply diversity until it is gone. For example, if the US power sector had been all natural gas–fired during the shale gas era to date, the average fuel cost for power would have been over twice as high, and month-to-month power bill variation (standard deviation) would have been three times greater (see Table 3). This estimate itself is conservative because the additional demand from power generation would have likely put significant upward pressure on gas prices.

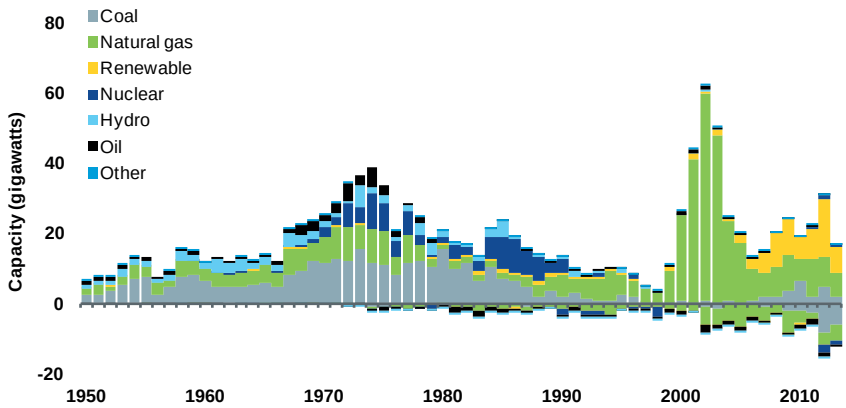
Trends in the US generation mix

The current diverse fuel and technology mix in US power supply did not come about by accident. The US generation mix evolved over many decades and reflects the fuel and technology decisions made long ago for power plants that typically operate for 30 to 50 years or more. Consequently, once a fuel and technology choice is made, the power system must live with the consequences—whatever they are—for decades.

US power supply does not evolve smoothly. The generation mix changes owing to the pace of power plant retirements, the error in forecasting power demand, price trends and other developments in the energy markets, and the impacts of public policy initiatives. All three of these factors unfold unevenly over time. The current diverse generation mix evolved from multiyear cycles of capacity additions that were typically dominated by a particular fuel and technology (see Figure 15). The swings in fuel and technology choice do not indicate a lack of appreciation for diverse power supply. Instead, they show that given the size of the existing supply base, it takes a number of years of homogenous supply additions to move the overall supply mix a small proportion. Therefore, altering the overall mix slightly required a number of years of adjustment.

FIGURE 15

US generating capacity additions and retirements, 1950–2013



Source: IHS Energy, Ventyx Velocity Suite

The uneven historical pattern of capacity additions is important because the future pattern of retirements will tend to reflect the previous pattern of additions as similarly aged assets reach the end of their useful lives. For example, current retirements are disproportionately reducing the coal and nuclear shares in the capacity mix, reflecting the composition of power plants added in the 1960s through 1980s. Current power plant retirements are about 12,000 MW per year and are moving the annual pace of retirements in the next decade to 1.5 times the rate of the past decade.

Power plant retirements typically need to be replaced because electricity consumption continues to increase. Although power demand increases are slowing compared to historical trends and compared to the growth rate of GDP, the annual rate of change nevertheless remains positive. US power demand is expected to increase between 1.0% and 2.5% each year in the decade ahead, averaging 1.5%.

The expected pace of US power demand growth reflects a number of trends. First, US electric efficiency has been improving for over two decades. Most appliances and machinery have useful lives of many years. As technology improves, these end uses get more efficient. Therefore, overall efficiency typically increases as appliances and machinery wear out and are replaced. On the other hand, the number of electric end uses keeps expanding and the end-use penetration rates keep increasing owing to advances in digital and communication technologies that both increase capability and lower costs. These trends in existing technology turnover

and new technology adoption produce a steady rate of change in electric end-use efficiency (see Figure 16).

Underlying trends in power demand are often masked by the influences of variations in the weather and the business cycle. For example, US electric output in first quarter 2014 was over 4% greater than in the same period one year ago owing in part to the influence of the polar vortex. Therefore, trend rates need to compare power consumption increases either between points in time with similar weather conditions or on a weather-normalized basis. Similarly, power demand trends can be misleading if compared without taking the business cycle into account. Figure 17 shows the trend rate of growth in power use from the previous business cycle peak to peak and tough to trough. Overall, power consumption increased by between 0.5 and 0.6 of the rate of increase in GDP. Looking ahead, GDP is expected to increase on average 2.5% annually through 2025 and thus is likely to produce a trend rate of electric consumption of around 1.5% annually. This US power demand growth rate creates a need for about 9 GW of new power supply per year, for a total of 1,140 GW by 2025.

FIGURE 16

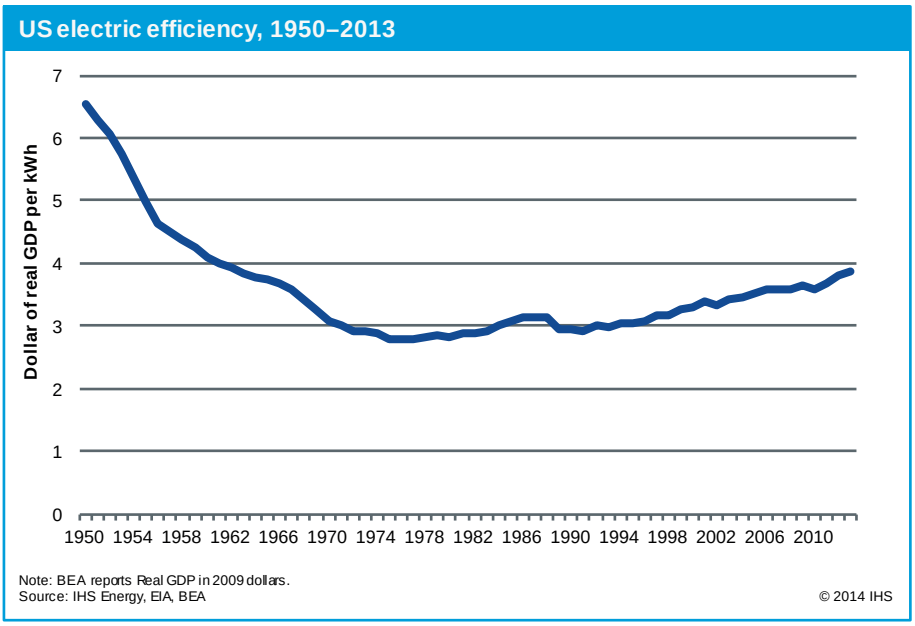
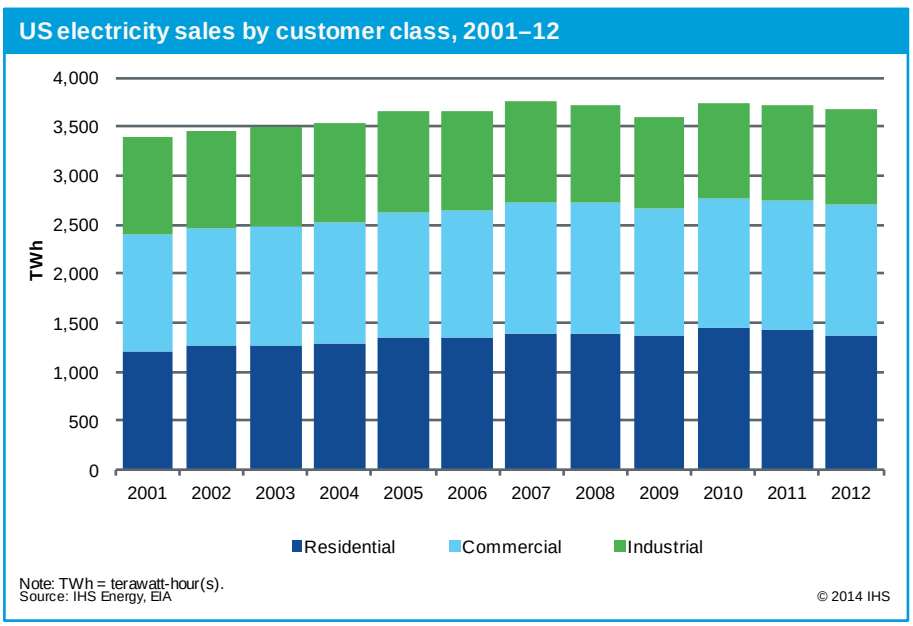


FIGURE 17



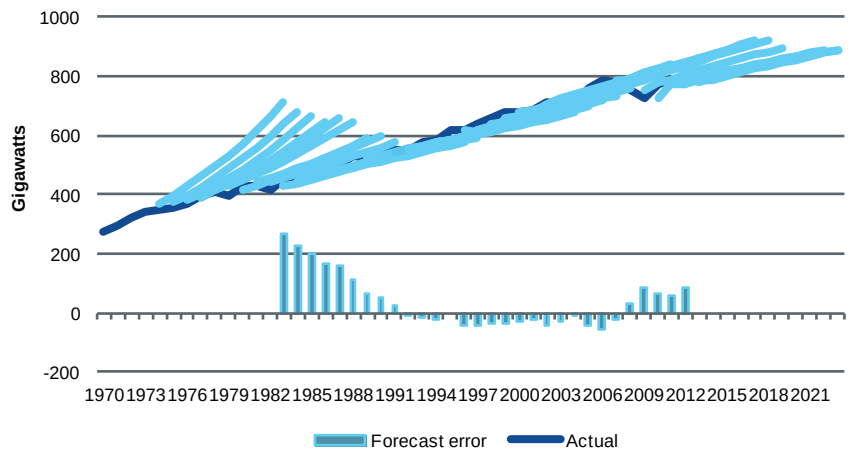
Annual power supply additions do not typically unfold simultaneously with demand increases. Historically, changes in power supply are much more pronounced than the changes in power demand. This uneven pace of change in the capacity mix reflects planning uncertainty regarding future power demand and a slow adjustment process for power supply development to forecast errors.

Future electric demand is uncertain. Figure 18 shows a sequence of power industry forecasts of future demand compared to the actual demand. The pattern of forecast errors indicates that electric demand forecasts are slow to adjust to actual conditions: overforecasts tend to be followed by overforecasts, and

underforecasts tend to be followed by underforecasts.

FIGURE 18

US power demand: Projected versus actual, 1983–2012



Source: IHS Energy
Data source: North American Electric Reliability Corporation

Forecasting uncertainty presents a challenge because fuel and technology decisions must be made years in advance of consumer demand to accommodate the time requirements for siting, permitting, and constructing new sources of power supply. As a result, the regional power systems are subject to momentum in power plant addition activity that results in capacity surpluses and shortages. Adjustment to forecast overestimates is slow because when a surplus becomes evident, the capital intensity of power plants creates an accumulating sunk-cost balance in the construction phase of power supply development. In this case, there is an economic incentive to finish constructing a power plant because the costs to finish are the relevant costs to balance against the benefits of completion. Conversely, if a shortage becomes evident, new peaking power plants take about a year to put into place under the best of circumstances. Consequently, the forecast error and this lagged adjustment process can produce a significant over/underinstallment of new capacity development versus need. These imbalances can require a decade or more to work off in the case of a capacity overbuild and at least a few years to shore up power supply in the case of a capacity shortage.

The pace and makeup of power plant additions are influenced by energy policies. The current installed capacity mix reflects impacts from the implementation of a number of past policy initiatives. Most importantly, 35 years ago energy security was a primary concern, and the energy policy response included the Fuel Use Act (1978) and the Public Utilities Regulatory Policy Act (1978). These policies limited the use of natural gas for power generation and encouraged utility construction of coal and nuclear generating resources as well as nonutility development of cogeneration. Public policy championed coal on energy security grounds—as a safe, reliable, domestic resource.

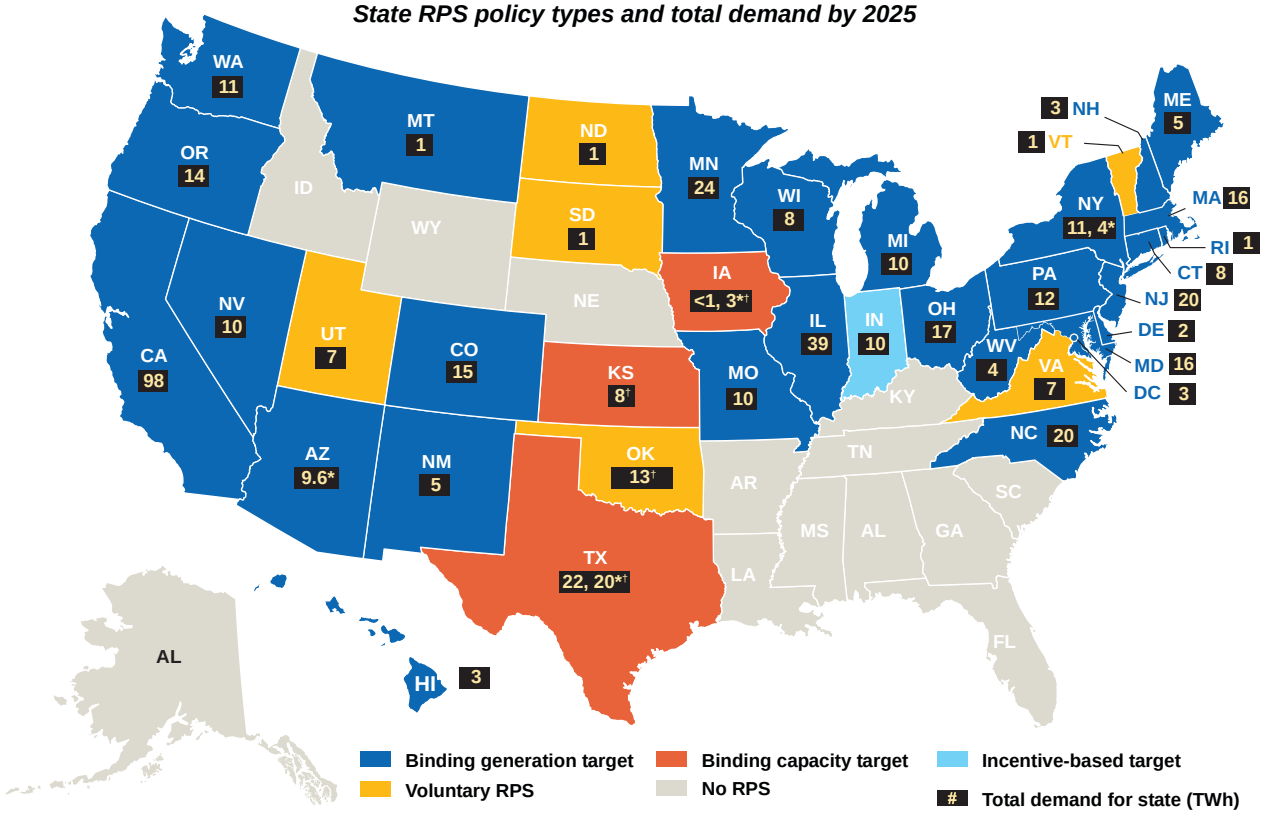
The influence of energy policy on power plant fuel and technology choice is dynamic. For example, as natural gas demand and supply conditions changed following the passage of the Fuel Use Act, the limits on natural gas use for power generation were eventually lifted in 1987. Whereas the Fuel Use Act banned a fuel and technology, other policy initiatives mandate power generation technologies. Energy policies designed to address the climate change challenge created renewable power portfolio requirements in 30 states (see Figure 19).

As states work to implement renewable generation portfolio standards, the complexity of power system operations becomes evident and triggers the need for renewable integration studies. These studies generally find that the costs to integrate intermittent power generation resources increase as the generation share of these resources increases. Some integration studies go so far as to identify the saturation point for wind resources based on their operational characteristics. A wind integration study commissioned by the

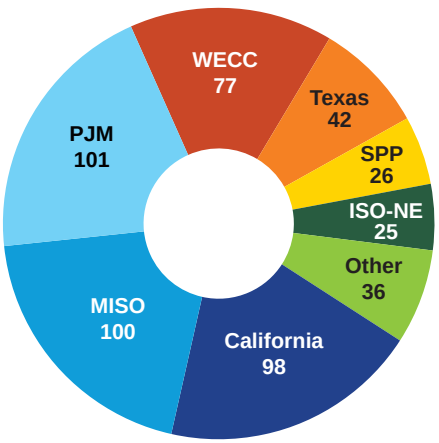
FIGURE 19

The outlook for US State RPS demand to 2025—Total demand: State policy and targets

State RPS policy types and total demand by 2025



Total RPS demand by region (TWh)



30 US states plus the District of Columbia have enacted binding renewable energy targets, and seven others have adopted incentive-based or voluntary targets. These 37 states account for 74% of US retail power sales.

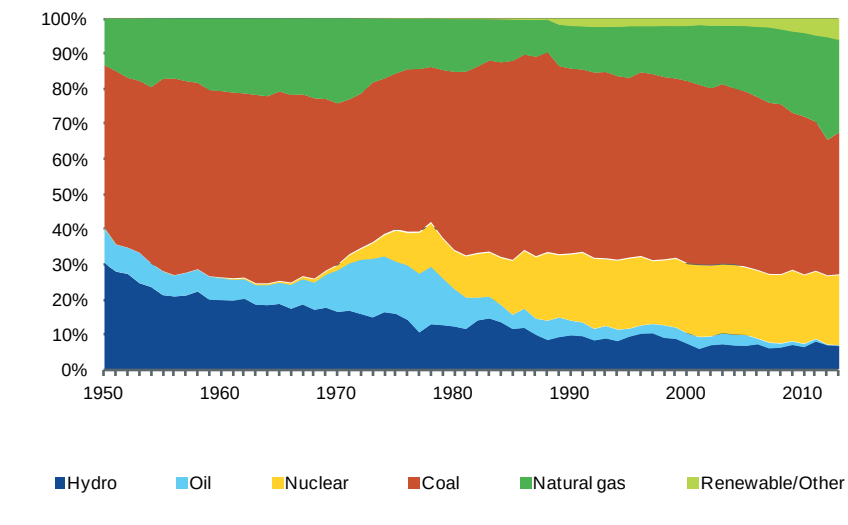
40609-3
Note: *States include both mandatory and voluntary targets; first number reflects mandatory target, second number reflects additional voluntary targets (of state, municipalities, or other political divisions/utilities).
†Capacity targets have been converted to generation for comparison using estimated regional capacity factors. All quantities reflect primary renewables; see page 2 for additional notes
Source: IHS Emerging Energy Research

power system operator in New England estimated the saturation point for wind in the power system (24% generation share) as well as the additional resources that would be needed to integrate more wind resources.[4] Similarly, a wind integration study by the power system operator in California found that problems were ahead for the California power system because the number of hours when too much wind generation was being put on the grid was increasing. The study noted higher costs were ahead as well because additional resources would be needed to integrate expected additional wind resources planned to meet the renewable portfolio requirements in place.[5] Many of the impacts on the US generation mix from renewable power portfolio requirements are yet to come as higher generation or capacity share mandates become binding in many states in the next few years.

The United States is at a critical juncture because current trends in power plant retirements, demand and supply balances, and public policies are combining to accelerate change in the US generation mix, as shown in Figure 20. In 2013, increases in demand, power plant retirements, and renewable mandates resulted in around 15,800 MW of capacity additions. In the decade ahead, these increasing needs will require power supply decisions amounting to 15% of the installed generating capacity in the United States. In addition, public policies are expected to increase the share of wind and solar generation, and forthcoming regulations from the Environmental Protection Agency (EPA) regarding conventional power plant emissions as well as greenhouse gases (GHG) could significantly increase power plant retirements and accelerate changes further. Altogether, changes in US generating capacity in the next two decades could account for more than one-third of installed capacity.

FIGURE 20

US power generation: shares by fuel, 1950–2013



Source: IHS Energy, EIA

Threat to power generation diversity: Complacency

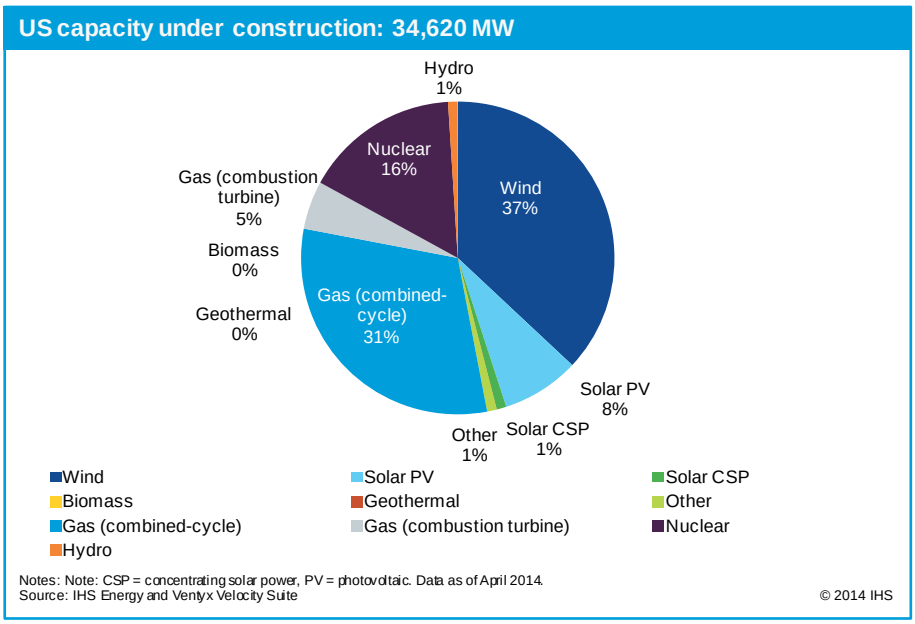
Threats to maintaining diversity in power production do not come from opposition to the idea itself, but rather from the complacency associated with simply taking diversity for granted. The familiar adage of not putting all your eggs in one basket is certainly aligned with the idea of an all-of-the-above energy policy. Four decades of experience demonstrates the conclusion that the government should not be picking fuel or technology winners, but rather should be setting up a level playing field to encourage competitive forces to move the power sector toward the most cost-effective generation mix. Nevertheless, in a striking contrast,

4. *New England Wind Integration Study* produced for ISO New England by GE Energy Applications and Systems Engineering, EnerNex Corporation, and AWS Truepower, 5 December 2010. Accessed 16 April 2014 (http://www.uwig.org/newis_es.pdf).

5. "Integration of Renewable Resources: Operational Requirements and Generation Fleet Capability at 20% RPS." California ISO, 31 August 2010, downloaded from www.caiso.com/2804/2804d036401f0.pdf.

the value of fuel diversity to the end use consumer is not internalized in current power plant decision making. A 2013 review of over eighty integrated resource plans (IRPs) found that many reference fuel diversity but only a few of them refer to it as a risk, and none of them quantify the value of fuel diversity to incorporate it into the decision process.[6] Additionally, environmental policy initiatives do not seem to accommodate diversity issues. Therefore, one power plant decision after another is revealing a de facto energy policy to move away from oil, coal, and nuclear generation and reduce hydroelectric capability, and instead build relatively low utilization wind and solar resources backed up by natural gas–fired generating units (see Figure 21).

FIGURE 21



Threat to power generation diversity: The "missing money"

Fuel diversity is threatened as well by the inability of power markets to evolve market rules and institutions to address the "missing money" problem in competitive power generator cash flows. The missing money problem in power markets is the latest manifestation of a long-standing problem in a number of industries, including railroads, airlines, and power, where competitive markets fail to balance demand and supply at market-clearing prices high enough to support the full cost of supply.

Power markets have a missing money problem because they do not have all of the necessary conditions to produce a textbook competitive marketplace. The textbook marketplace has suppliers who maximize their profits by expanding output up to the point where their short-run marginal cost (SRMC) of production equals the market-clearing price. This means that an aggregation of rival suppliers' SRMC curves produces the market supply curve. If this market supply curve intersects the market demand curve at a price too low to support the full cost of new supply (long-run marginal cost [LRMC]), then suppliers will not expand productive capacity. Instead, they will meet increases in demand by adding more variable inputs to the production process with a fixed amount of capacity. However, doing so increases SRMC, and eventually the market-clearing price rises to the point where it covers the cost of expanding productive capacity. This produces the textbook market equilibrium where demand and supply are in balance at the unique point where market-clearing prices are equal to both SRMC and LRMC.

Several characteristics of the technologies that make up a cost-effective power supply create a persistent gap between SRMCs and LRMCs as production varies. As a result, market-clearing wholesale power prices are below the level needed to support the full cost of power supply when demand and supply are in balance with the desired level of reliability.[7] Consequently, the stable textbook market equilibrium does not exist in an electric power marketplace.

6. See the IHS Energy Insight *Reading the Tea Leaves: Trends in the power industry's future plans.*

7. See the IHS Energy Private Report *Power Supply Cost Recovery: Bridging the missing money gap.*

A simple example of a competitive power market made up entirely of rival wind generators illustrates the missing money problem. The cost profile of wind turbine technologies comprises nearly exclusively upfront capital costs (LRMCs). SRMCs for wind technologies equal zero because the variable input to the power production process is wind, and this input is free. In a competitive market, if wind conditions allow for power production, then rival wind generators will be willing to take any price above zero to provide some contribution to recovering the upfront capital costs. If there is adequate supply to balance demand in a competitive marketplace, then rival wind suppliers will drive the market-clearing price to zero. This is not just a theoretical example. When power system conditions create wind-on-wind competition, then zero or negative market-clearing prices (reflecting the cost of losing the production tax credit) are typically observed. Wind generating technologies are a simple and extreme example of a power generating technology with a persistent gap between SRMCs and LRMCs. But this problem exists to some degree with other power generation technologies.

This technology-based market flaw means that periodic shortage-induced price spikes are the only way for market-clearing prices to close the gap between the SRMC and LRMC. This market outcome does not work because of the inherent contradiction—periodic shortages are needed to keep demand and supply in balance.

The missing money problem threatens cost-effective power supply because when market-clearing power prices are chronically too low to support new power plants, then lower expected cash flows at existing plants cause retirements before it is economic to do so, given replacement costs. It is cost effective to retire and replace a power plant only when its cost of continued operation becomes greater than the cost of replacement. Therefore, a market-clearing power price that reflects the full cost of new power supply is the appropriate economic signal for efficient power plant closure and replacement. Consequently, when this price signal is too low, power plant turnover accelerates and moves power supply toward the reduced diversity case.

"Missing money" and premature closing of nuclear power plants

The Kewaunee nuclear plant in Wisconsin is an example of a power plant retirement due to the missing money problem. Wholesale day-ahead power prices average about $30 per MWh in the Midwest power marketplace. This market does not have a supply surplus, and recently the Midwest Independent System Operator (MISO), the institution that manages the wholesale market, announced that it expects to be 7,500 MW short of generating capacity in 2016.[8] The current market-clearing power price must almost double to send an efficient price signal that supports development of a natural gas–fired combined-cycle power plant.

The Kewaunee power plant needs much less than the cost of a new plant, about $54 per MWh, to cover the costs of continued operation. Kewaunee's installed capacity was 574 MW, and the plant demonstrated effective performance since it began operation in 1974. The plant received Nuclear Regulatory Commission approval for life extension through 2033. Nevertheless, the persistent gap between market prices and new supply costs led Dominion Energy, the power plant's owner, to the October 2012 decision to close the plant because of "low gas prices and large volumes of wind without a capacity market."

Kewaunee is not an isolated case. Other nuclear power plants such as Vermont Yankee provide similar examples. Additionally, a significant number of coal-fired power plants are retiring well before it is economic to do so. For example, First Energy retired its Hatfield's Ferry plant in Ohio on 9 October 2013. This is a large (1,700 MW) power plant with a $33 per MWh variable cost of power production.[9] The going-forward

8. Whieldon, Esther. "MISO-OMS survey of LSEs, generators finds resource shortfall remains likely in 2016." SNL Energy, 6 December 2013. Accessed on 14 May 2014 http://www.snl.com/InteractiveX/ArticleAbstract.aspx?id=26168778. Note: LSE = load-serving entity.

9. Source: SNL Financial data for 2012 operations, accessed 5 May 2014. Available at http://www.snl.com/InteractiveX/PlantProductionCostDetail.aspx?ID=3604.

costs involved some additional environmental retrofits, but the plant had already invested $650 million to retrofit a scrubber just four years prior to the announced retirement.

Reducing diversity and increasing risk

Proposed EPA regulations on new power plants accommodate the carbon footprint of new natural gas–fired power plants but do not accommodate the carbon footprint of any new state-of-the-art conventional coal-fired power plants that do not have carbon capture and storage (CSS). Since the cost and performance of CSS technologies remain uneconomic, the United States is now on a path to eliminating coal-fired generation in US power supply expansion. This move toward a greatly reduced role for coal in power generation may accelerate because the EPA is now developing GHG emission standards for existing power plants that could tighten emissions enough to dramatically increase coal-fired power plant retirements.

The impact of a particular fuel or technology on fuel diversity depends on overall power system conditions. As a general rule, the benefits of fuel diversity from any source typically increase as its share in the portfolio decreases. Oil-fired generation illustrated this principle when it proved indispensable in New England in keeping electricity flowing this past winter. Despite only accounting for 0.2% of US generation, it provided a critical safety valve for natural gas deliverability during the polar vortex. Yet, these oil-fired power plants are not likely to survive the tightening environmental regulations across the next decade. The implication is clear: there is a much higher cost from losing this final 0.2% of oil in the generation mix compared to the cost of losing a small percentage of oil-fired generation back in 1978, when oil accounted for 17% of the US generation mix. Losing this final 0.2% of the generation mix will be relatively expensive because the alternative to meet infrequent surges in natural gas demand involves expanding natural gas storage and pipeline capacity in a region where geological constraints make it increasingly difficult to do so.

Public opinion is a powerful factor influencing the power generation mix. The loss of coal- or oil-fired power plants in the generation mix is often ignored or dismissed because of public opinion. Coal- or oil-fired power plants are generally viewed less favorably than wind and solar resources. In particular, labeling some sources of power as “clean energy” necessarily defines other power generating sources as “dirty energy.” This distinction makes many conventional power supply sources increasingly unpopular in the political process. Yet, all sources of power supply employed to meet customer needs have an environmental impact. For example, wind and solar resources require lots of land and must be integrated with conventional grid-based power supply to provide consumers with electricity when the wind is not blowing or the sun is not shining. Therefore, integrating these “clean energy” resources into a power system to meet consumer needs produces an environmental footprint, including a GHG emission rate. The arbitrary distinctions involved in “clean energy” are evident when comparing the emissions profiles of integrated wind and solar power production to that of nuclear power production. A simplistic and misleading distinction between power supply resources is a contributing factor to the loss of fuel diversity.

Edison International provides an example of the impact of public opinion. Antinuclear political pressures in California contributed to the decision in 2013 to prematurely close its San Onofre nuclear power plant. This closure created a need for replacement power supply that is more expensive, more risky, and more carbon intensive.

The going-forward costs of continued operation of the San Onofre nuclear plant were less than the cost of replacement power. Therefore, the closure and replacement of the San Onofre power plant made California power supply more expensive in a state that already has among the highest power costs in the nation. A study released in May 2014 by the Energy Institute at Haas at the University of California Berkeley estimated that closing the San Onofre nuclear power station increased the cost of electricity by $350 million during the

first twelve months.[10] This was a large change in power production costs, equivalent to a 13% increase in the total generation costs for the state.

Closing San Onofre makes California power costs more risky. California imports about 30% of its electricity supply. Prior to the closure, nuclear generation provided 18.3% of California generation in 2011, and the San Onofre nuclear units accounted for nearly half of that installed nuclear capacity. The Haas study found that imports increase with system demand but not much, likely owing to transmission constraints, grid limitations, and correlated demand across states. The results imply that the loss of the San Onofre power plant was primarily made up through the use of more expensive generation, as much as 75% of which was out-of-merit generation running to supply energy as well as voltage support. The report's analysis found that up to 25% of the lost San Onofre generation could have come from increased imports of power. The substitute power increases California consumers' exposure to the risks of fossil fuel price movements as well as the risks of low hydroelectric generation due to Western Interconnection drought cycles.

Closing San Onofre makes California power production more carbon intensive. Nuclear power production does not produce carbon dioxide (CO_2) emissions. These nuclear units were a major reason that the CO_2 intensity of California power production was around 0.5 pounds (lb) per kilowatt-hour (kWh). Replacement power coming from in-state natural gas–fired power plants has associated emissions of about 0.9 lb per kWh. Replacement power coming from the rest of the Western Interconnection has associated emissions of 1.5 lb per kWh. Even additional wind and solar power sources in California with natural gas–fired power plants filling in and backing them up have a 0.7 lb per kWh emissions profile. The Haas study found that closing San Onofre caused carbon emissions to increase by an amount worth almost $320 million, in addition to the $350 million in increased electricity prices in the first year. In the big picture, California CO_2 emissions have not declined in the past decade, and the closure of the San Onofre nuclear units will negate the carbon abatement impacts of 20% of the state's current installed wind and solar power supply.

The path toward a less diverse power supply

The relative unpopularity of coal, oil, nuclear, and hydroelectric power plants (compared to renewables), combined with the missing money problem, tightening environmental regulations, and a lack of public awareness of the value of fuel diversity create the potential for the United States to move down a path toward a significant reduction in power supply diversity. Within a couple of decades, the US generation mix could have the following capacity characteristics:

- No meaningful nuclear power supply share
- No meaningful coal-fired power supply share
- No meaningful oil-fired power supply share
- Hydroelectric capacity in the United States reduced by 20%, from 6.6% to 5.3% of installed capacity
- Renewables power supply shares at operational limits in power supply mix: 5.5% solar, 27.5% wind
- Natural gas–fired generation becoming the default option for the remaining US power supply of about 61.7%

10. http://ei.haas.berkeley.edu/pdf/working_papers/WP248.pdf, accessed 30 May 2014.

Comparing the performance of current diverse power supply to this reduced diversity case provides a basis for quantifying the current value of fuel and technology diversity in US power supply.

Quantifying the value of current power supply diversity

A number of metrics exist to compare and contrast the performance of power systems under different scenarios. Three power system performance metrics are relevant in judging the performance of alternative generation portfolios:

- SRMC of electric production (the basis for wholesale power prices)
- Average variable cost of electric production
- Production cost variability

IHS Energy chose a geographic scope for the diversity analyses at the interconnection level of US power systems. The United States has three power interconnections: Electric Reliability Council of Texas (ERCOT), Eastern, and Western. These interconnections define the bounds of the power supply network systems that coordinate the synchronous generation and delivery of alternating current electrical energy to match the profile of aggregate consumer demands in real time.

Analysis at the interconnection level is the minimum level of disaggregation needed to analyze the portfolio and substitution effects of a diverse fuel and technology generation mix. In particular, the substitution effect involves the ability to shift generation from one source of power supply to another. The degree of supply integration within an interconnection makes this possible, whereas the power transfer capability between interconnections does not. The degree of power demand and supply integration within these interconnections creates the incentive and capability to substitute lower-cost generation for higher-cost generation at any point in time. These competitive forces cause the incremental power generation cost-based wholesale power prices at various locations within each interconnection to move together. An average correlation coefficient of monthly average wholesale prices at major trading hubs within each interconnection is roughly 0.8, indicating a high degree of supply linkage within each interconnection.

IHS Energy assessed the current value of fuel diversity by using the most recently available data on the US power sector. Sufficient data were available for 2010 to 2012, given the varied reporting lags of US power system data.

IHS employed its Razor Model to simulate the interactions of demand and supply within each of these US power interconnections from 2010 to 2012. The 2010 to 2012 backcasting analysis created a base case of the current interactions between power demand and supply in US power systems. Appendix B describes the IHS Razor Model and reports the accuracy of this power system simulation tool to replicate the actual performance of these power systems. The high degree of predictive power produced by this model in the backcasting exercise establishes the credibility of using this analytical framework to quantify the impacts of more or less fuel and technology diversity. The macroeconomic impact analysis used the most recently available IHS simulation of the US economy (December 2013) as a base case.

Once this base case was in place, the Razor Model was employed to simulate an alternative case involving a less diverse generation mix. The current generation mix in each of the three interconnections—Eastern, Western, and ERCOT—were altered as follows to produce the reduced diversity case generation:

- The nuclear generating share went to zero.
- The coal-fired electric generating share went to zero.
- The hydroelectric generation share dropped to 3.8%.
- Intermittent wind and solar generation increased its combined base case generation share of about 2% to shares approximating the operational limits—24% in the East, 45% in the West, and 23% in ERCOT—resulting in an overall wind generation share of 21.0% and a solar generation share of 1.5%.
- Natural gas–fired generation provided the remaining generation share in each power system, ranging from about 55% in the West to over 75% in the East and ERCOT, for an overall share of nearly 74%.

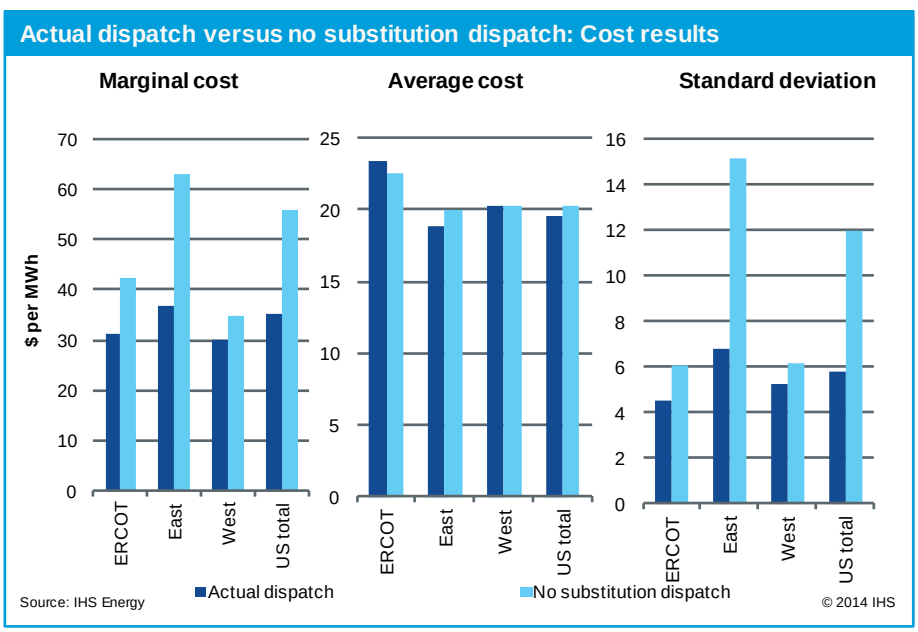
Differences between the performance metrics of the current diverse generating portfolio simulation and the reduced diversity case simulation provide an estimate for the current value of fuel diversity. The differences in the level and variance of power prices were fed through to the IHS US macroeconomic model to quantify the broader economic impacts of the higher and more varied power prices and shifts in capital deployment associated with the reduced diversity case.

Quantification of the impact of fuel diversity within the US power sector involved a two-step process. The first step quantifies the current value of the substitution effect enabled by a diverse power generating portfolio. The second step quantified the additional value created by the portfolio effect.

The value of the substitution effect

The first step alters the base case by holding relative fuel prices at the average level across 2010 to 2012. Doing this removes the opportunity to substitute back and forth between generation resources based on changes to the marginal cost of generation. This case maintains a portfolio effect but eliminates the substitution effect in power generation. The difference between this constant relative fuel price case and the base case provides an estimate of the current value of the substitution effect provided by the current diverse power generation fuel mix. The results show significantly higher fuel costs from a generation mix deprived of substitution based on fuel price changes. The substitution effects in the current diverse US power generating portfolio reduced the fuel cost for US power production by over $2.8 billion per year. In just the three years of the base case, US power consumers realized nearly $8.5 billion in fuel savings from the substitution effect. Figure 22 shows the results of this first step in the analysis for each interconnection and the United States as a whole.

FIGURE 22

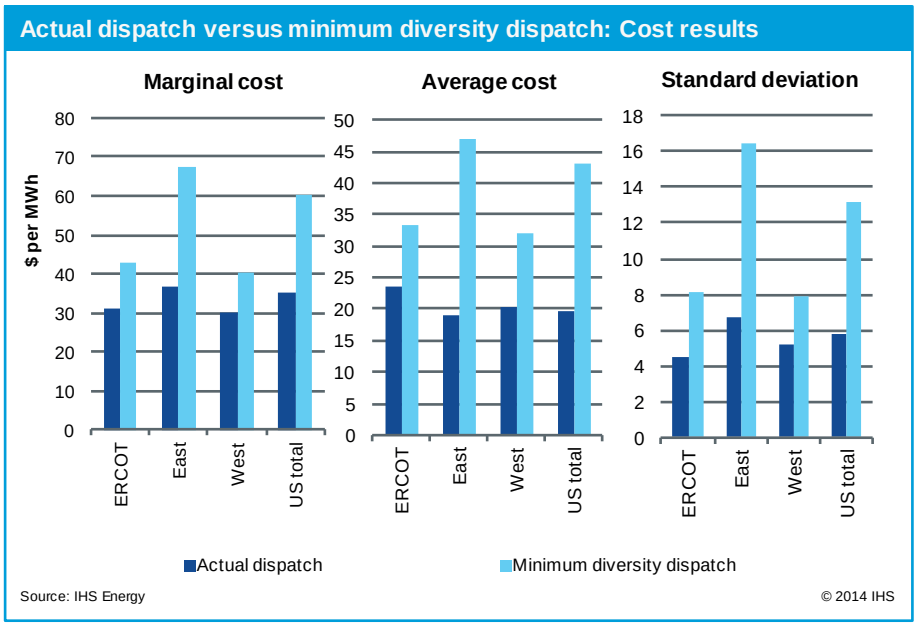


The value of the portfolio effect

The second step quantifies the portfolio value of the current generation mix. To measure this, the base case is altered by replacing the actual current generation mix with the less diverse generation mix. All else is held constant in this reduced diversity case, including the actual monthly fuel prices. Therefore, this reduced diversity simulation reduces the portfolio effect of diverse generation and allows any economic generation substitution to take place utilizing this less diverse capacity mix.

Figure 23 shows the performance metrics for each interconnection and the United States as a whole in the less diverse portfolio case compared to the base case.

FIGURE 23



The portfolio effect reduces not only costs, but also the variation in costs. This translates into a reduction in the typical monthly variation in consumers' power bills of between 25% and 30%.

The differences in average power production costs between the reduced diversity case and the current supply case indicate that fuel and technology diversity in the base case US generation mix provides power consumers with benefits of $93 billion per year. This difference between the reduced diversity case and the base case includes both the substitution and portfolio effects. Using the results of step one allows separation of these two effects, as shown in Table 4.

Figures 24 and 25 show the progression from the base case to the reduced diversity case. The results indicate that the Eastern power interconnection has the most to lose from a less diverse power supply because it faces more significant increases in cost, price, and variability in moving from the base case to the reduced diversity case. The Eastern interconnection ends up with greater variation in part because its delivered fuel costs are more varied than in Texas or the West. In addition, the natural endowments of hydroelectric power in the Western interconnection generation mix continue to mitigate some of the fuel price risk even at a reduced generation share.

In the past three years, generation supply diversity reduced US power supply costs by $93 billion per year, with the majority of the benefit coming from the portfolio effect. These estimates are conservative because they were made only across the recent past, 2010 to 2012. An evaluation over a longer period of history would show increased benefits from managing greater levels of fuel price risk.

The estimates of the current value of power supply diversity are conservative as well because they do not include the feedback effects of higher power cost variation on the cost of capital for power suppliers, as outlined in Appendix A. The analyses indicate that a power supplier with the production cost variation equal to the current US average would have a cost of capital 310 basis points lower than a power supplier

TABLE 4

Diversity cases cost results

		Substitution effect	Portfolio effect	Total
ERCOT	Output (2011, TWh)	334	334	334
	Marginal cost increase ($/MWh)	$11.10	$0.35	$11.45
	Average cost increase ($/MWh)	($0.91)	$10.62	$9.71
	Marginal cost increase split	97%	3%	100%
	Average cost increase split	-9%	109%	100%
	Marginal cost increase percentage	35.40%	1.10%	36.50%
	Average cost increase percentage	-3.90%	45.20%	41.40%
	Marginal cost increase (total)	$3,708,970,847	$116,702,120	$3,825,672,967
	Average cost increase (total)	($302,604,000)	$3,547,080,000	$3,244,476,000
Eastern interconnection	Output (2011, TWh)	2,916	2,916	2,916
	Marginal cost increase ($/MWh)	$26.01	$4.73	$30.74
	Average cost increase ($/MWh)	$1.10	$26.92	$28.02
	Marginal cost increase split	85%	15%	100%
	Average cost increase split	4%	96%	100%
	Marginal cost increase percentage	70.70%	12.80%	83.50%
	Average cost increase percentage	5.80%	142.70%	148.50%
	Marginal cost increase (total)	$75,840,639,098	$13,791,489,884	$89,632,128,981
	Average cost increase (total)	$3,207,600,000	$78,498,720,000	$81,706,320,000
Western interconnection	Output (2011, TWh)	728	728	728
	Marginal cost increase ($/MWh)	$4.94	$5.27	$10.21
	Average cost increase ($/MWh)	($0.10)	$11.67	$11.57
	Marginal cost increase split	48%	52%	100%
	Average cost increase split	-1%	101%	100%
	Marginal cost increase percentage	16.50%	17.60%	34.10%
	Average cost increase percentage	-0.50%	57.50%	57.00%
	Marginal cost increase (total)	$3,593,597,137	$3,837,638,788	$7,431,235,926
	Average cost increase (total)	($72,800,000)	$8,495,760,000	$8,422,960,000
US total	Output (2011, TWh)	3,978	3,978	3,978
	Marginal cost increase ($/MWh)	$20.90	$4.46	$25.36
	Average cost increase ($/MWh)	$0.71	$22.76	$23.47
	Marginal cost increase split	82%	18%	100%
	Average cost increase split	3%	97%	100%
	Marginal cost increase percentage	59.50%	12.70%	72.20%
	Average cost increase percentage	3.60%	116.70%	120.30%
	Marginal cost increase (total)	$83,143,207,082	$17,745,830,792	$100,889,037,874
	Average cost increase (total)	$2,832,196,000	$90,541,560,000	$93,373,756,000

Source: IHS Energy

with the production cost variation associated with the generation mix of the reduced diversity case. Since 14% of total power costs are returned to capital, this difference accounts for 1–3% of the overall cost of electricity. This cost-of-capital effect can have a magnified impact on overall costs if more capital has to be deployed with an acceleration of power plant closures and replacements from the pace that reflects underlying economics.

The cost of accelerating change in the generation mix

Current trends in public policies and flawed power market outcomes can trigger power plant retirements before the end of a power plant's economic life. When this happens, the closure creates cost impacts beyond the level and volatility of power production costs because it requires shifting capital away from a productive alternative use and toward a replacement power plant investment.

All existing power plants are economic to close and replace at some point in the future. The economic life of a power plant ends when the expected costs of continued operation exceed the cost of replacement. When

this happens, the most cost-effective replacement power resource depends on the current capacity mix and what type of addition creates the greatest overall benefit—including the impact on the total cost of power and the management of power production cost risk.

Figure 26 shows the current distribution of the net present value (NPV) of the going-forward costs for the existing US coal-fired generation fleet on a cents per MWh basis in relation to the levelized NPV of replacement power on a per MWh basis.

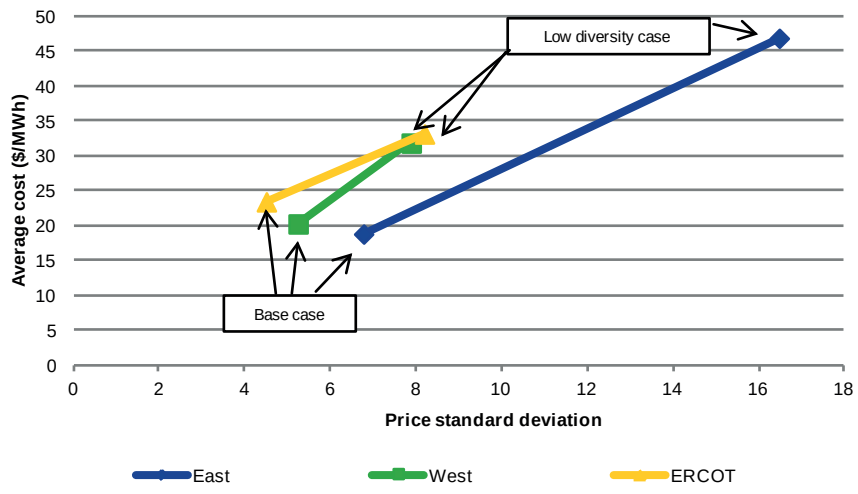
As the distribution of coal-fired power plant going-forward costs indicates, there is a significant difference between the going-forward costs and the replacement costs for the majority of plants. As a result, a substantial cost exists to accelerate the turnover of coal-fired power plants in the capacity mix. For example, closing coal-fired power plants and replacing them as quickly as possible with natural gas–fired power plants would impose a turnover cost of around $500 billion.

Figure 27 shows the going-forward costs of the existing US nuclear power plant fleet. As with the coal units, there is currently a high cost associated with premature closure. As a point of comparison, closing all existing nuclear power plants and replacing them as quickly as possible with natural gas–fired power plants would impose a turnover cost of around $230 billion. Unlike the coal fleet, where a nominal amount of older capacity has a going-forward cost that exceeds the expected levelized cost of replacement, none of the US nuclear capacity is currently more expensive than the lowest of projected replacement costs.

Closing a power plant and replacing it before its time means incurring additional capital costs. The average depreciation rate of capital in the United States is 8.3%. This implies that the average economic life of a

FIGURE 24

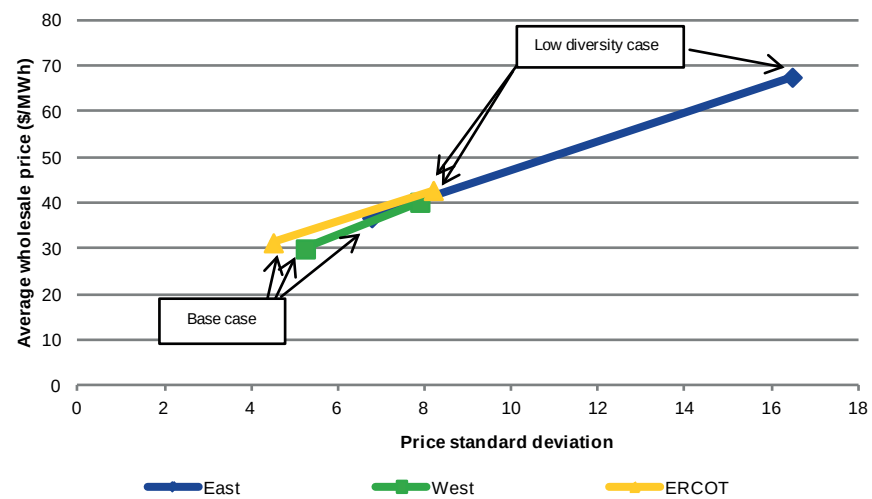
Average cost: Base case versus low diversity case



Source: IHS Energy

FIGURE 25

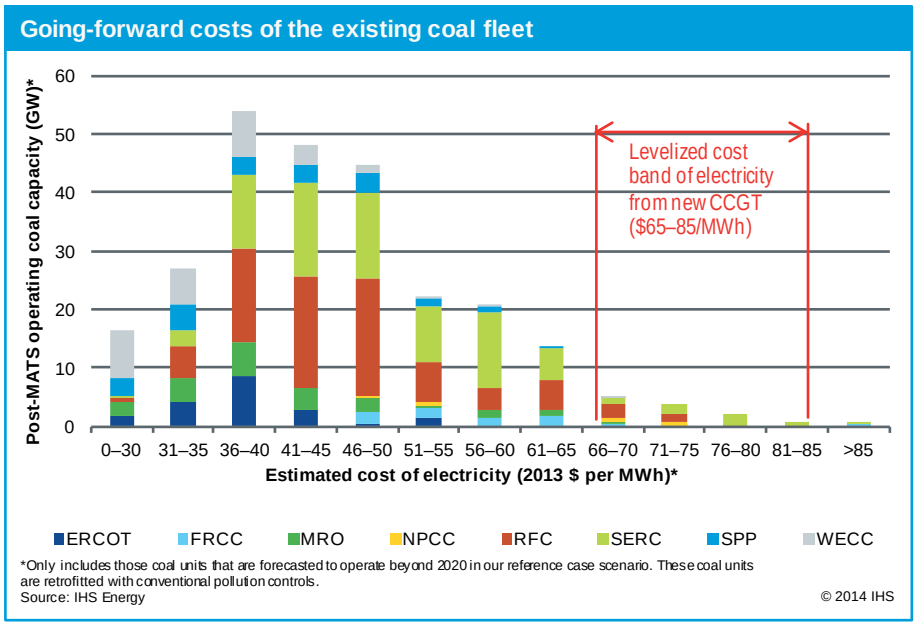
Average wholesale price: Base case versus low diversity case



Source: IHS Energy

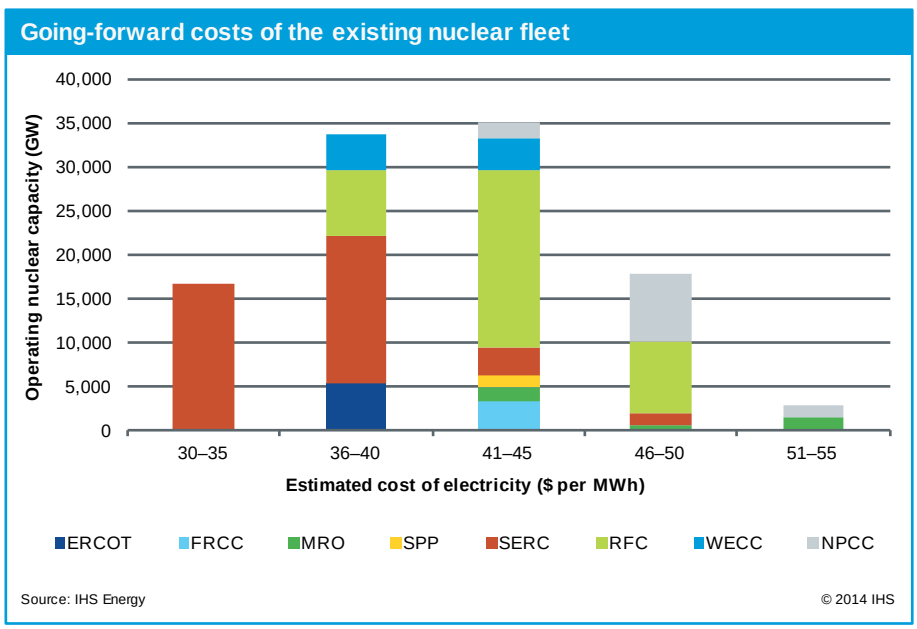
capital investment in the United States economy is 12 years. Altering the amount of capital deployed in the US economy by $1 in Year 1 results in an equivalent impact on GDP as deploying a steady stream of about $0.15 of capital for each of the 12 years of economic life. This annual levelized cost approximates the value of the marginal product of capital. Therefore, each dollar of capital deployed to replace a power plant that retires prematurely imposes an opportunity cost equal to the value of the marginal productivity of capital in each year.

FIGURE 26



Economywide impacts

FIGURE 27



In addition to the $93 billion in lost savings from the portfolio and substitution effects, depending upon the pace of premature closures, there is a cost to the economy of diverting capital from other productive uses. The power price increases associated with the reduced diversity case would profoundly affect the US economy. The reduced diversity case shows a 75% increase in average wholesale power prices compared to the base case. IHS Economics conducted simulations using its US Macroeconomic Model to assess the potential impact of the change in the level and variance of power prices between the base case and the reduced diversity case. The latest IHS base line macroeconomic outlook in December 2013 provides a basis for evaluating the impacts of an electricity price shock due to a reduced diversity case for power supply. Subjecting the current US economy to such a power price increase would trigger economic disruptions, some lasting over a multiyear time frame. As a result, it would take several years for most of these disruptions to dissipate. To capture most of these effects, power price changes were evaluated over the period spanning the past two and the next three years to approximate effects of a power price change to the current state of the economy. Wholesale power price increases were modeled by increasing the

Producer Price Index for electricity by 75% in the macroeconometric model; consumers were affected by the resulting higher prices for retail electricity and other goods and services.

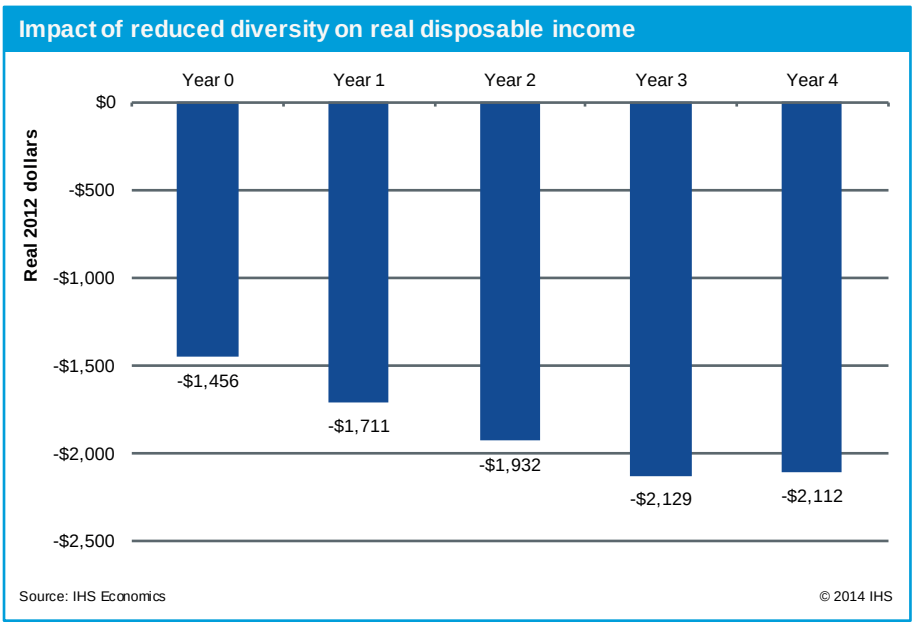
Economic impacts of the power supply reduced diversity case are quantified as deviations from the IHS macroeconomic baseline simulations of the US economy. The major impacts within the three years after the power price change would include

- A drop in real disposable income per household of about $2,100
- A reduction of 1,100,000 jobs
- A decline in real GDP of 1.2%

Consumers will bear the brunt of the impact of higher power prices. The higher price of electricity would trigger a reduction in power use in the longer run (10 or more years out) of around 10%. Yet even with such dramatic reductions in consumption, the typical power bill in the United States would increase from around $65 to $72 per month.

Not only will consumers face higher electric bills, but some portion of increases in manufacturers' costs ultimately will be passed on to consumers through higher prices for goods and services. Faced with lower purchasing power, consumers will scale back on discretionary purchases because expected real disposable income per household is lower by over $2,100 three years after the electric price increase (see Figure 28). Unlike other economic indicators (such as real GDP) that converge toward equilibrium after a few years, real disposable income per household does not recover, even if the simulations are extended out 25 years. This indicates that the price increases will have a longer-term negative effect on disposable income and power consumption levels.

FIGURE 28



Businesses will face the dual challenge of higher operational costs coupled with decreased demand for their products and services. Industrial production will decline, on average, by about 1% through Year 4. This will lead to fewer jobs (i.e., a combination of current jobs that are eliminated and future jobs that are never created) within a couple of years relative to the IHS baseline forecast, as shown in Figure 29, with the largest impact appearing in Year 2, with 1,100,000 fewer jobs than the IHS baseline level.

Impact on GDP

The US economy is a complex adaptive system that seeks to absorb shocks (e.g., increases in prices) and converge toward a long-term state of equilibrium. Although the simulations conducted for this study do not project that the US economy will fall into a recession because of power price increases, it is informative to gauge the underperformance of the US economy under the reduced diversity case. In essence, the higher power prices resulting from the reduced diversity conditions cause negative economic impacts equivalent to a mild recession relative to the forgone potential GDP of the baseline. The economic impacts of the reduced diversity case set back GDP by $198 billion, or 1.2% in Year 1 (see Figure 30). This deviation from the baseline GDP is a drop that is equivalent to about half of the average decline in GDP in US recessions since the Great Depression. However, the impacts on key components of GDP such as personal consumption and business investment will differ.

FIGURE 29

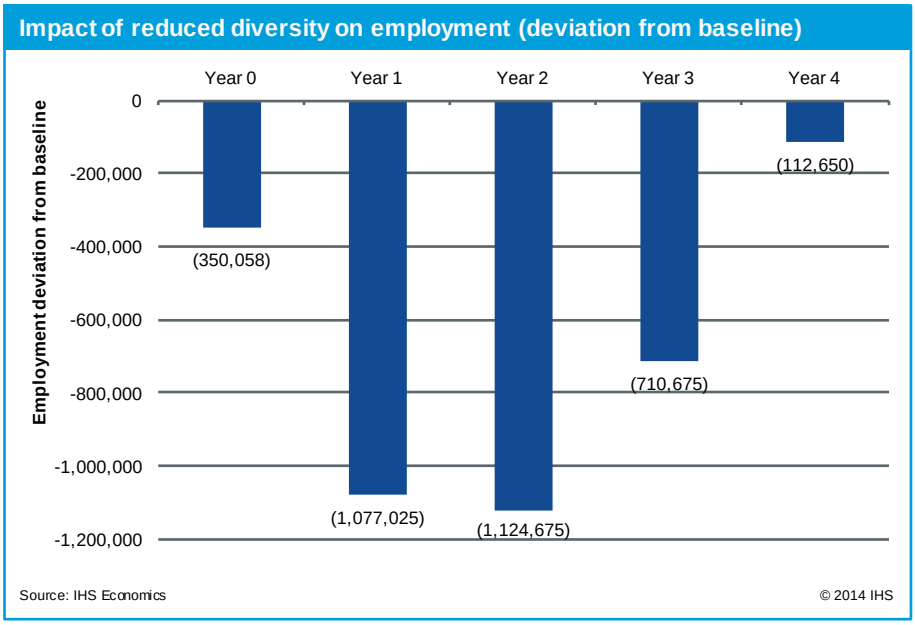
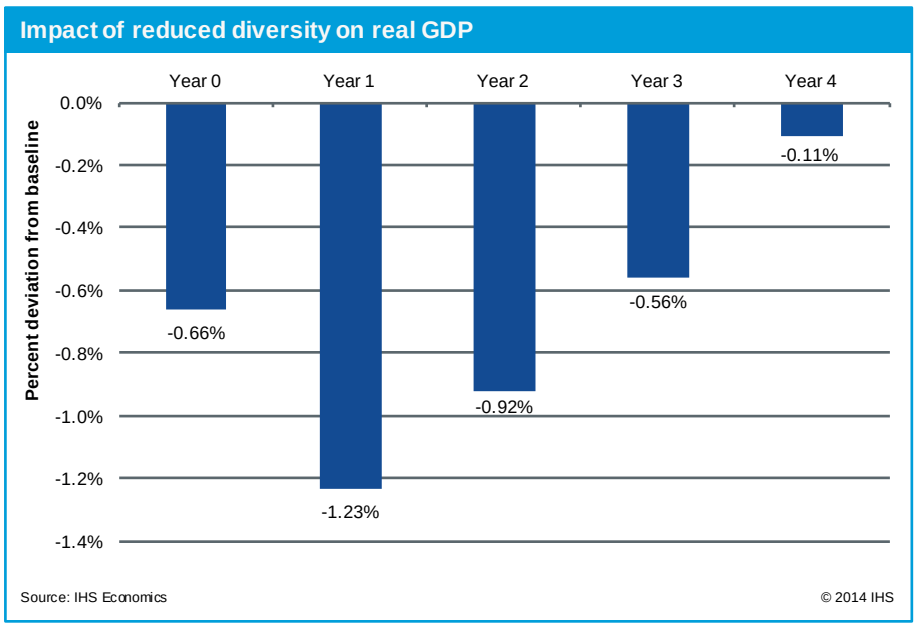


FIGURE 30

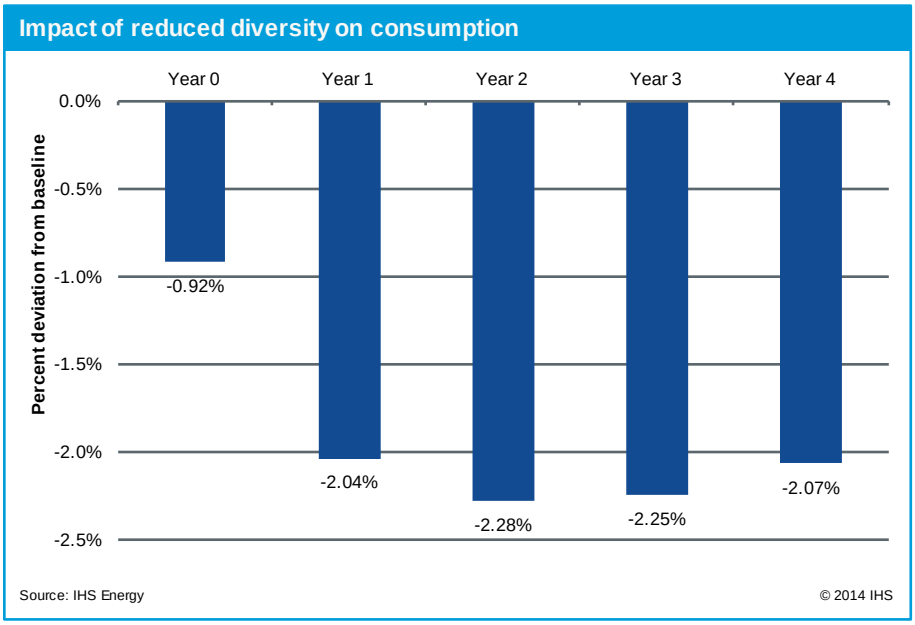


Consumption

Analyzing personal consumption provides insights on the changes to consumer purchasing behavior under the scenario conditions. Consumption, which accounts for approximately two-thirds of US GDP, remains lower over the period with each of its three subcomponents—durable goods, nondurable goods, and services—displaying a different response to the reduced power supply scenario conditions. In contrast with overall GDP, consumer spending shows little recovery by Year 4, as shown in Figure 31. This is due to continued higher prices for goods and services and decreased household disposable income. About 57% of the decline will occur in purchases of services, where household operations including spending on electricity will have a significant impact.

In the early years, lower spending on durable goods (appliances, furniture, consumer electronics, etc.) will account for about 33% of the decline, before moderating to 25% in the longer term. This indicates that consumers, faced with less disposable income, will simply delay purchases in the early years. The US macro simulations also predict moderate delays in housing starts and light vehicle sales, ostensibly due to consumers trying to minimize their spending.

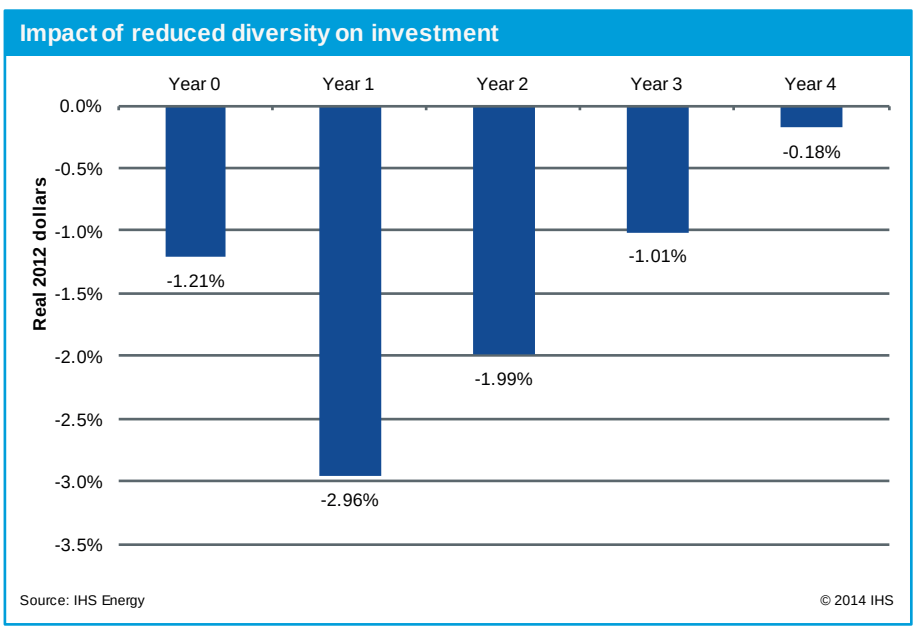
FIGURE 31



Investment

Following an initial setback relative to the baseline, investment will recover by the end of the forecast horizon. Nonresidential investment will initially be characterized by delays in equipment and software purchases, which will moderate a few years after the electric price shock. Spending on residential structures will remain negative relative to the baseline over the four years, as shown in Figure 32. The net effect in overall investment is a recovery as the economy rebounds back to a long-run equilibrium.

FIGURE 32



In the longer term, if current trends cause the reduced diversity case to materialize within the next decade, then the premature closure and replacement of existing power plants would shift billions of dollars of capital from alternative deployments in the US economy.

Conclusions

Consumers want a cost-effective generation mix. Obtaining one on the regulated and public power side of the industry involves employing an integrated resource planning process that properly incorporates

cost-effective risk management. Obtaining such a mix on the competitive side of the power business involves employing time-differentiated market-clearing prices for energy and capacity commodities that can provide efficient economic signals. The linkage between risk and cost of capital can internalize cost-effective risk management into competitive power business strategies. Regardless of industry structure, a diverse generation mix is the desired outcome of cost-effective power system planning and operation.

The results of this study indicate seven key factors that will shape US power supply diversity in the years to come:

- **Energy policy development.** US policy heavily influences the US power supply mix. Implementing an all-of-the-above energy policy requires properly internalizing the value of fuel diversity.

- **Market structure.** Market flaws distort wholesale power prices downward and result in uneconomic retirement and replacement of existing cost-effective generation resources. This issue and any market structure changes to address it will significantly shape future power plant development.

- **Energy policy discourse.** Preserving the value of fuel diversity depends on public awareness and understanding. The extent and nature of public education regarding the value of power supply diversity may strongly influence public opinion.

- **Planning alignment.** Alignment of fuel and technology choices for power generation with engineering and economic principles is critical to efficient and reliable supply. There is no single fuel or technology of choice for power generation, and all forms of power production have economic, environmental, and reliability impacts.

- **Risk assessment.** To incorporate system considerations into plant-level decisions, prudent fuel price uncertainties must be used with probabilistic approaches to decision making.

- **Flexibility.** Flexibility and exemptions in rule making and implementation allow for the balancing of costs and benefits in power supply systems and may help preserve highly valuable diversity in systemwide decisions as well as on a small but impactful individual plant scale.

- **Scope.** Including fuel price risk and additional storage and transportation infrastructure costs is crucial when evaluating reduced diversity scenarios in comparison to the cost of maintaining and expanding fuel diversity.

Appendix A: Cost-effective electric generating mix

The objective of power supply is to provide reliable, efficient, and environmentally responsible electric production to meet the aggregate power needs of consumers at various points in time. Consumers determine how much electricity they want at any point in time, and since the power grid physically connects consumers, it aggregates individual consumer demands into a power system demand pattern that varies considerably from hour to hour. For example, Figure A-1 shows the hourly aggregate demand for electricity in ERCOT.

In order to reliably meet aggregate power demands, enough generating capacity needs to be installed and available to meet demand at any point in time. The overall need for installed capacity is determined by the peak demand and a desired reserve margin. A 15% reserve margin is a typical planning target to insure reliable power supply.

The chronological hourly power demands plus the required reserve margin allow the construction of a unitized load duration curve (see Figure A-2). The unitized load duration curve orders hourly electric demands from highest to lowest and unitizes the hourly loads by expressing the values on the y-axis as a percentage of the maximum (peak) demand plus the desired reserve margin. The x-axis shows the percentage of the year that load is at or above the declining levels of aggregate demand.

This unitized load duration curve has a load factor—the ratio of average load to peak load—of 0.60. Although load duration curve shapes vary from one power system to another, this load factor and unitized load duration curve shape is a reasonable approximation of a typical pattern of electric

FIGURE A-1

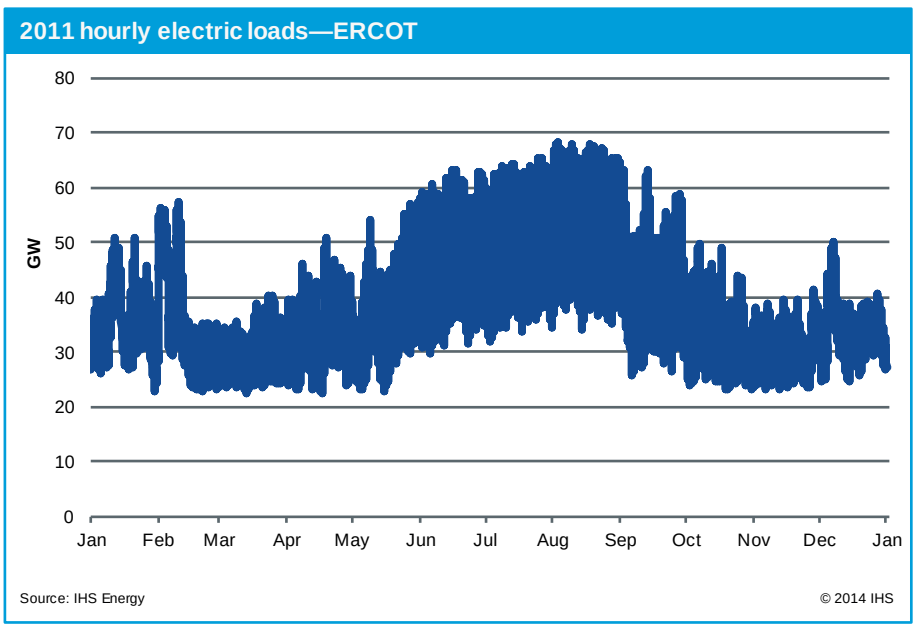
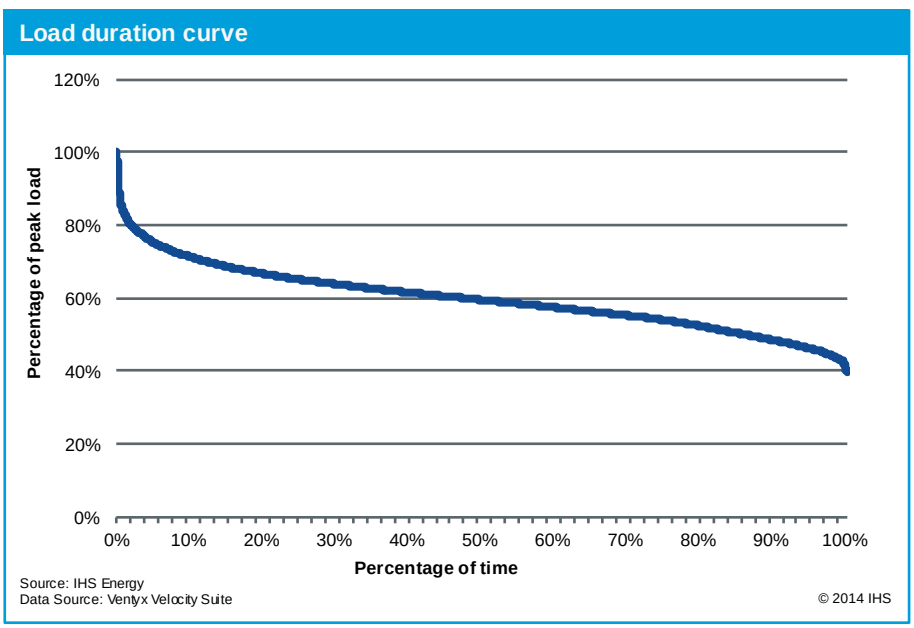


FIGURE A-2



demand in a US power system. The objective of any power system would be to match its demand pattern with cost-effective power supply.

There are a number of alternative technologies available to produce electricity. These power supply alternatives have different operating characteristics. Most importantly, some power generating technologies can produce electricity on demand that aligns with the pattern of consumer demand through time, while others cannot. For example, solar PV panels can only provide electric output during hours of sunlight and thus cannot meet aggregate demand during the night. In contrast, thermal generation such as coal and natural gas can ramp up and down or turn on and off to match output with customer demand. Technologies such as coal and natural gas are considered dispatchable, while technologies such as solar and wind are considered nondispatchable. A number of combinations of technologies can together provide electric output that matches the pattern of consumer needs.

The lowest-cost generating technologies that can meet the highest increases in demand are peaking technologies such as combustion turbines (CTs). CTs are the most economical technology to meet loads that occur for only a small amount of time. These technologies can start-up quickly and change output flexibly to meet the relatively infrequent hours of highest power demand. They are economic even though they are not the best available technology for efficiently transforming fuel into electricity. CTs have relatively low upfront capital costs and thus present a trade-off with more efficient but higher capital cost generating technology alternatives. Since these resources are expected to be used so infrequently, the additional cost of more efficient power generation is not justified by fuel savings, given their expected low utilization rates.

Cycling technologies are most economical to follow changes in power demand across most hours. Consequently, utilization rates can be high enough to generate enough fuel savings to cover the additional capital cost of these technologies over a peaking technology. These intermediate technologies provide flexible operation along with efficient conversion of fuel into power. A natural gas–fired combined-cycle gas turbine (CCGT) is one technology that is suitable and frequently used for this role.

Base-load technologies are the lowest-cost power supply sources to meet power demand across most hours. These technologies are cost-effective because they allow the trading of some flexibility in varying output for the lower operating costs associated with high utilization rates. These technologies include nuclear power plants, coal-fired power plants, and reservoir hydroelectric power supply resources.

Nondispatchable power resources include technologies such as run-of-the-river hydroelectric, wind, and solar power supplies. These technologies produce power when external conditions allow—river flows, wind speeds, and solar insolation levels. Variations in electric output from these resources reflect changes in these external conditions rather than changes initiated by the generator or system operator to follow shifts in power consumer needs. Some of these resources can be economic in a generation mix if the value of the fuel they displace and their net dependable capacity are enough to cover their total cost. However, since nondispatchable production profiles do not align with changes in consumer demands, there are limits to how much of these resources can be cost-effectively incorporated into a power supply mix.

Alternative power generating technologies also have different operating costs. Typical cost profiles for alternative power technologies are shown in Table A-1. Both nuclear and supercritical pulverized coal (SCPC) technologies are based on steam turbines, whereby superheated steam spins a turbine; in coal's case, supercritical refers to the high-pressure phase of steam where heat transfer and therefore the turbine itself is most efficient. Natural gas CTs are akin to jet engines, where the burning fuel's exhaust spins the turbine. A CCGT combines both of these technologies, first spinning a CT with exhaust and then using that exhaust to create steam which spins a second turbine.

TABLE A-1

Typical cost profiles for alternative power technologies

	CCGT	SCPC	Nuclear	CT
Capital cost (US$ per kW)	1,350	3,480	7,130	790
Variable O&M cost (US$ per MWh)	3.5	4.7	1.6	4.8
First year fixed O&M cost (US$ per kW-yr)	13	39	107	9
Property tax and insurance (US$ per kW-yr)	13	36	78	8
Fuel price (US$ per MMBtu)	4.55	2.6	0.7	4.55
Heat rate (Btu per kWh)	6,750	8,300	9,800	10,000
CO_2 emission rate (lbs per kWh)	0.8	1.73	0	1.18

Total capital cost figures include owner's costs: development/permitting, land acquisition, construction general and administrative, financing, interest during construction, etc.

Source: IHS Energy

Power production technologies tend to be capital intensive; the cost of capital is an important determinant of overall costs. The cost of capital is made up of two components: a risk-free rate of return and a risk premium. Short-term US government bond interest rates are considered an approximation of the risk-free cost of capital. Currently, short-term US government bond interest rates are running at 0.1%. In order to attract capital to more risky investments, the return to capital needs to be greater. For example, the average cost of new debt to the US investor-owned power industry is around 4.5%.[11] This indicates an average risk premium of 4.4%.

Power generating technologies have different risk profiles. For example, the fluctuations in natural gas prices and demand levels create uncertainty in plant utilization and the level of operating costs and revenues. This makes future net income uncertain. Greater variation in net income makes the risk of covering debt obligations greater. In addition, more uncertain operating cost profiles add costs by imposing higher working capital requirements.

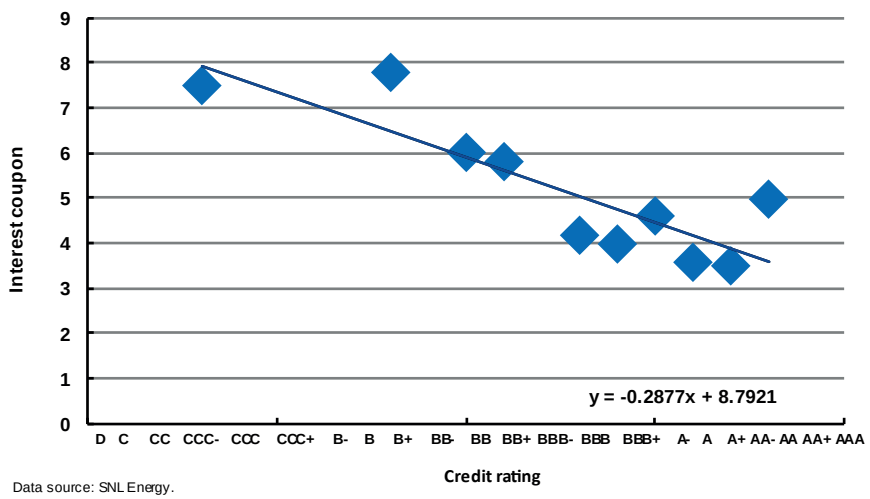
Risk profiles are important because they affect the cost of capital for power generation projects. If a project is seen as more risky, investors demand a higher return for their investment in the project, which can have a significant impact on the overall project cost.

Credit agencies provide risk assessments and credit ratings to reflect these differences. Credit ratings reflect the perceived risk of earning a return on, and a return of, capital deployments. As Figure A-3 shows, the higher credit ratings associated with less risky investments have a lower risk premium, and conversely lower credit ratings associated with more risky investments have a higher risk premium.

Lower credit ratings result from higher variations in net

FIGURE A-3

2010 shareholder-owned utilities senior debt offerings average interest coupon versus credit rating



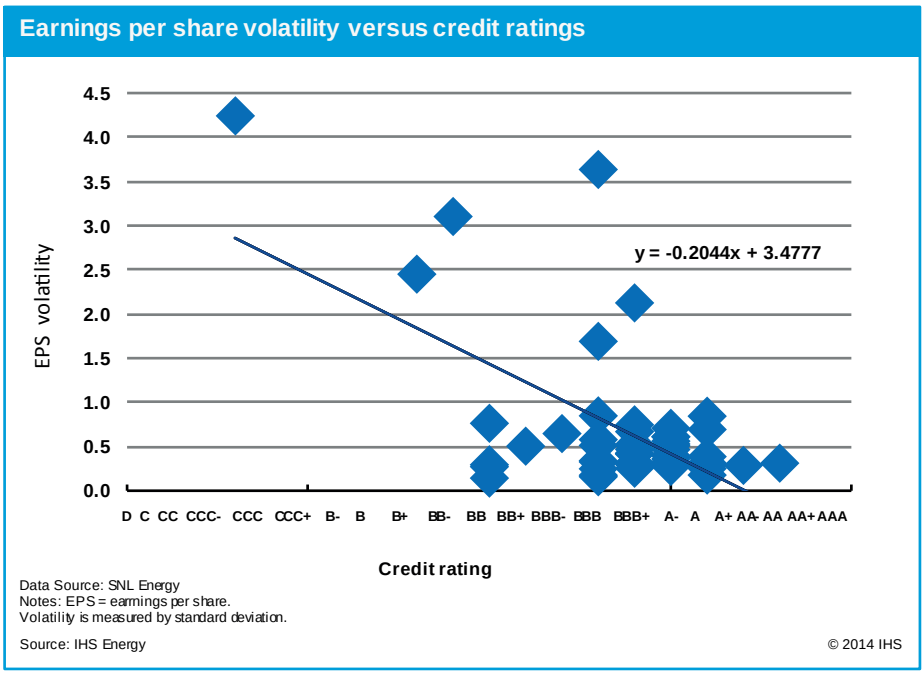
Data source: SNL Energy.

Source: IHS Energy

11. Data collected by Stern School of Business, NYU, January 2014. Cost of Capital. Accessed at http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/wacc.htm.

income, as shown in Figure A-4.

FIGURE A-4



Sometimes the cost of capital is directly related to the power plant when project financing is used. In other cases, power companies raise capital at the corporate level with a capital cost that reflects the overall company risk profile rather than just the power plant risk profile. Utilities typically have diverse power supply portfolios, whereas merchant generators tend to be much less diverse—typically almost entirely natural gas-fired. As a result of the different supply mixes and associated risk profiles, utilities and merchant generators have different costs of capital. This difference in the cost of capital provides an approximation of the difference in risk premium.

Overall, the cost of capital for merchant generators is higher than that for utilities broadly. While the power industry has an average cost of debt of roughly 4.5%, merchant generators with significant natural gas holdings tend to have a cost of debt of around 8%. As many of these firms have gone through bankruptcies in the past, this number may be lower than the cost of debt these firms had prior to restructuring.[12] The implied risk premium of a merchant generator to a utility is 3.5%, which is similar to the cost of capital analysis results discussed in the body of the report, where the reduced diversity case generator was calculated to have a cost of capital 310 basis points (3.1%) higher than that of the current US power sector as a whole.

Merchant generators with majority natural gas holdings have higher costs of capital because of the increased earnings volatility and risk of an all natural gas portfolio. In contrast, a generator with a more diverse portfolio needing to secure financing for the same type of plant would have costs of capital more in line with the industry as a whole. This can have a significant impact on the overall cost of the plant. This is not due specifically to the properties of natural gas as a fuel, but rather to the diversity of generating resources available. If a merchant generator were to have an exclusively coal-fired generating fleet or an exclusively nuclear generating fleet, its cost of capital would also increase owing to the higher uncertainty in generation cash flows.

The expected annual power supply costs can be calculated over the expected life of a power plant once the cost of capital is set and combined with the cost and operating profile data. These power costs are uneven through time for a given utilization rate. Therefore, an uneven cost stream can be expressed as a levelized cost by finding a constant cost in each year that has the same present value as the uneven cost stream. The discount rate used to determine this present value is based on the typical cost of capital for the power

12. Based on analysis of the "Competitive" business strategy group, defined by IHS as businesses with generation portfolios that are over 70% nonutility, based on asset value and revenue. Cost of debt based on coupon rates of outstanding debt as of May 2014.

industry as a whole. Dividing the levelized cost by the output of the power plant at a given utilization rate produces a levelized cost of energy (LCOE) for a given technology at a given utilization rate (see Figure A-5).

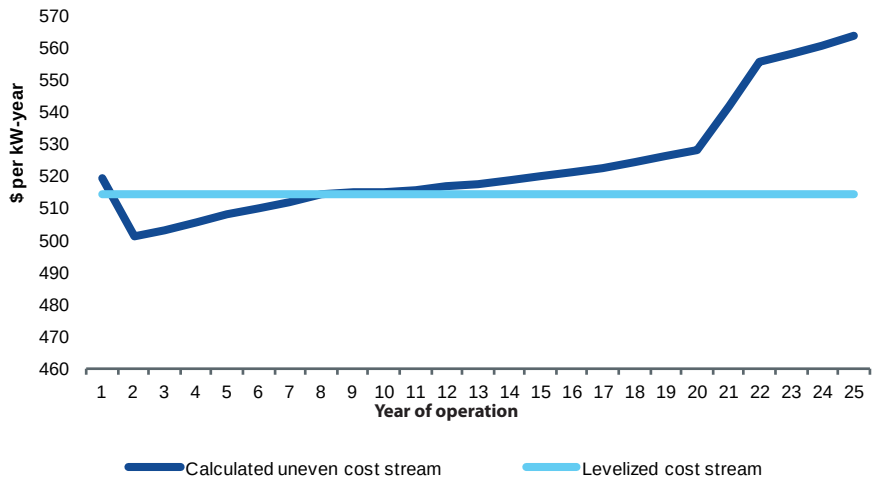
A levelized cost stream makes it possible to compare production costs at different expected utilization rates. A lower utilization rate forces spreading fixed costs over fewer units of output and thus produces higher levelized costs (see Figure A-6).

Figure A-7 adds the LCOE of a CT. Since the LCOE of the CT is lower than that of the CCGT at high utilization rates, adding CTs shows the point at which the savings for a CCGT's greater efficiency in fuel use are enough to offset the lower fixed costs of a CT.

There is a utilization rate at which a CCGT is cheaper to run than a CT. Below a utilization rate of roughly 35%, a CT is more economical. At higher utilization rates, the CCGT is more economical. When referring back to the load duration curve, it can be calculated that a generation mix that is 37% CT and 63% CCGT would produce a least-cost outcome. This can be demonstrated by comparing the LCOE graph with the load duration curve: the intersection point of CT and CCGT LCOEs occurs at the same time percentage on the LCOE graph at which 63% load occurs on the load duration curve (see Figure A-8).

FIGURE A-5

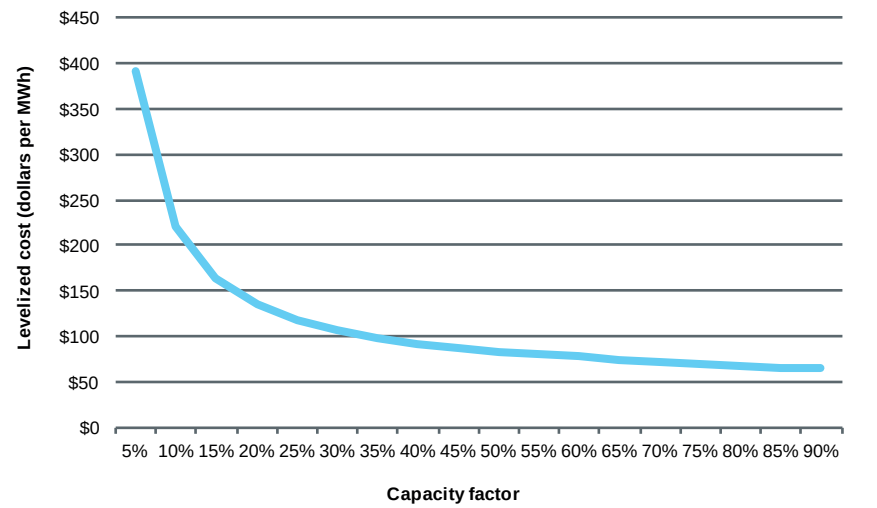
Cost stream comparisons—CCGT, 85% utilization rate



Source: IHS Energy

FIGURE A-6

LCOE of CCGT generation



Source: IHS Energy

The levelized cost of production for each technology can be determined by finding the average load (and corresponding utilization rate) for the segment of the load duration curve (LDC) that corresponds to each technology (in this example, the two segments that are created by splitting the curve at the 35% mark). Loads that occur less than 35% of the time will be considered peak loads, so the average cost of meeting

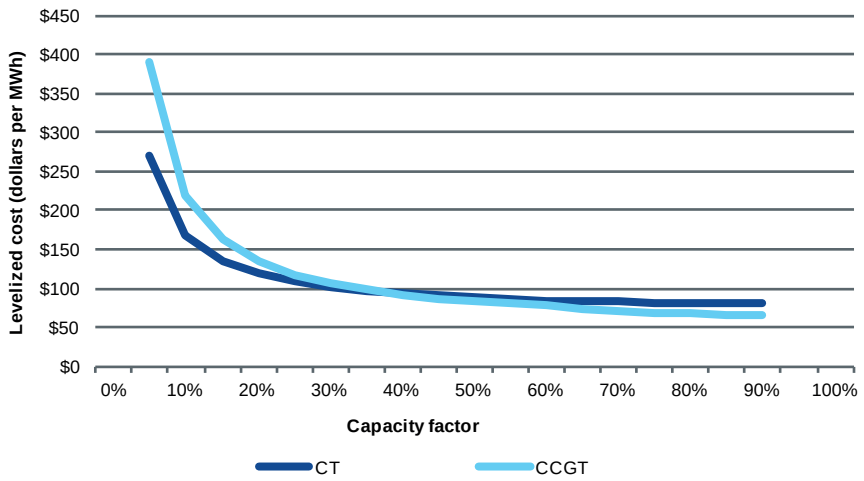
a peak load will be equivalent to the cost of a CT operating at a 17.5% utilization rate, the average of the peak loads. Cycling loads will be defined as loads occurring between 35% to 80% of the time, with base loads occurring more than 80% of the time. As the CCGT is covering both cycling and base loads in this example, the average cost of meeting theses loads with a CCGT will be equivalent to the levelized cost of a CCGT at a 57.5% utilization rate. A weighted average of the costs of each technology is then equivalent to an average cost of production for the power system. For this generation mix, the levelized cost of production is equal to 9.6 cents per kWh.

The generating options also can be expanded to include fuels besides natural gas. Stand-alone coal and stand-alone nuclear are not lower cost than stand-alone gas, as shown in Figure A-9, and all have a high-risk premium associated with the lack of diversity. However, when combined as part of a generation mix, the cost of capital will be lower owing to the more diverse (and therefore less risky) expected cash flow.

Based on the LDC, in this example base-load generation was modeled at 52.5% of capacity and was composed of equal parts gas, coal, and nuclear capacity. This combination of fuels and technology produces a diverse portfolio that can reduce risk and measurably lower the risk premium in the cost of capital. The point at which a CCGT becomes cheaper than a CT changes slightly from the previous example owing to the change in cost of capital, but the result is similar, with a 30% utilization rate the critical point and 36% CT capacity the most economical. Cycling loads with utilization

FIGURE A-7

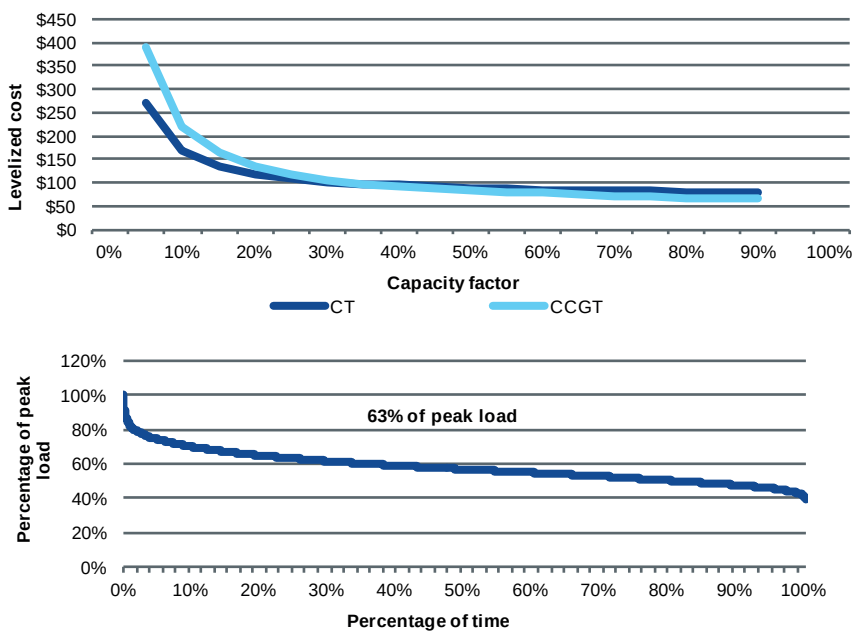
LCOE of CCGT and CT generation



Source: IHS Energy

FIGURE A-8

Determination of generation mix based on load duration curve



Source: IHS Energy
Data Source: Ventyx Velocity Suite, National Renewable Energy Laboratory

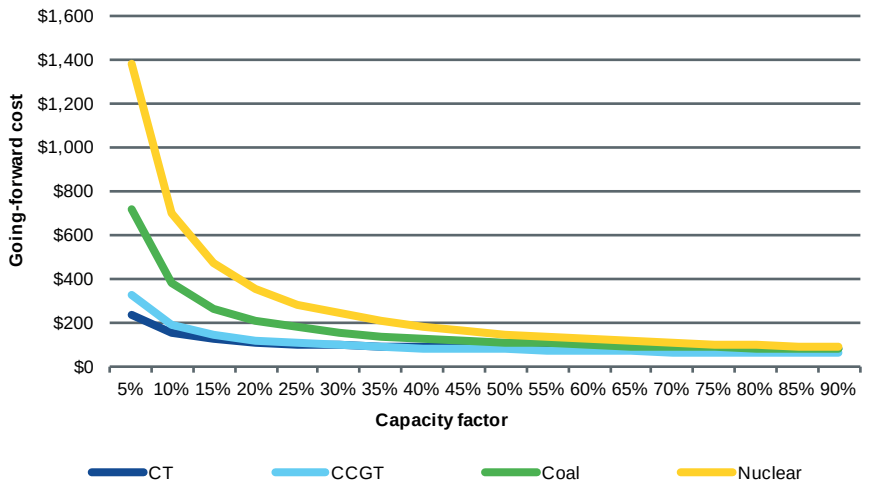
Source:

rates between 30% and 80% can be covered by CCGTs, equaling 11.5% of capacity. The levelized cost of production for this more diverse portfolio is equal to 9.3 cents per kWh. Even though coal and nuclear have higher levelized costs than gas, all else being equal, the reduced cost of capital is more than enough to offset the increased costs of generation. The implication is that a least-cost mix to meet a pattern of demand is a diverse mix of fuels and technologies.

If the power system has a renewables mandate, this can be incorporated as well. Solar PV has a levelized cost of 14.2 cents per kWh, given a 4.5% cost of capital. If solar made up 10% of generating capacity, the load duration curve for the remaining dispatchable resources would change, as shown in Figure A-10. Using hourly solar irradiation data from a favorable location to determine solar output, the peak load of the power system does not change, as there is less than full solar insulation in the hour when demand peaks.[13] The load factor for this new curve is 0.58, a small decrease from the original curve. A lower load factor typically means that larger loads occur less often, so more peaking capacity is necessary.

FIGURE A-9

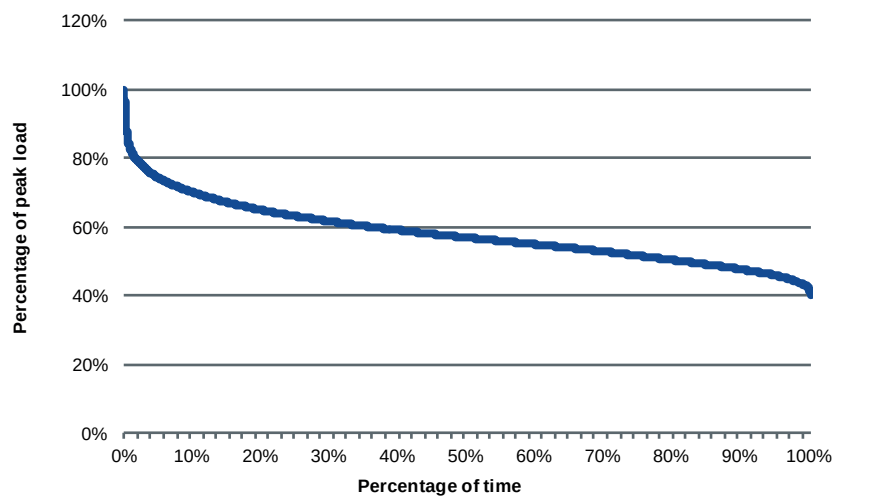
Levelized cost curves of generating resources



Source: IHS Energy

FIGURE A-10

Load duration curve, after solar additions



Source: IHS Energy
Data Source: Ventyx Velocity Suite, National Renewable Energy Laboratory

The needed dispatchable resources can be recalculated using the new curve, integrating the solar generation. The new curve increases the amount of peaking resources needed, but otherwise changes only very slightly. After solar is added, the total cost is 10.8 cents per kWh. Since the output pattern of solar doesn't match the demand pattern for the power system, adding solar does not significantly decrease the amount of capacity needed.

13. Solar data from National Renewable Energy Laboratory, Austin, TX, site. Data from 1991–2005 update, used for example purposes. http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/by_state_and_city.html accessed 13 May 2014.

Conclusion

- There is no single fuel or technology of choice for power generation. Reliably and efficiently supplying consumers with the amounts of electricity that they want, when they want it, requires a diverse generation mix.

- A cost-effective generation mix involves diversity but does not involve maximizing diversity by equalizing generation shares from all available supply options.

- The cost-effective mix of fuel and technologies for any power system is sensitive to the uncertainties surrounding the level and pattern of consumer power demands as well as expectations regarding the cost and performance of alternative power generating technologies and, in particular, the expectations for delivered fuel prices.

- The cost-effective generating mix will differ from one power system to the next because of differences in aggregate consumer demand patterns as well as the cost and performance of available generating options.

- The best type of capacity to add to any generation portfolio depends on what types of capacity are already in the mix.

Appendix B: IHS Power System Razor Model overview

Design

The IHS Power System Razor (Razor) Model was developed to simulate the balancing of power system demand and supply. The model design provides flexibility to define analyses' frequency and resolution in line with available data and the analytical requirements of the research investigation.

For this assessment of the value of fuel diversity, the following analytical choices were selected:

- **Analysis time frame**—Backcasting 2010 to 2012
- **Analysis frequency**—Weekly balancing of demand and supply
- **Geographic scope**—US continental power interconnections—Western, Eastern, and ERCOT
- **Demand input data**—Estimates of weekly interconnection aggregate consumer energy demand plus losses
- **Fuel and technology types**—Five separate dispatchable supply alternatives: nuclear, coal steam, natural gas CCGT, gas CT, and oil CT
- **Supply input data by type**—Monthly installed capacity, monthly delivered fuel prices, monthly variable operations and maintenance (O&M), heat rate as a function of utilization
- **Load modifiers**—Wind, solar, hydroelectric, net interchange, peaking generation levels, and weekly patterns

Demand

The Razor Model enables the input of historical demand for backcasting analyses as well as the projection of demand for forward-looking scenarios. In both cases, the Razor Model evaluates demand in a region as a single aggregate power system load.

For backcasting analyses, the model relies upon estimates of actual demand by interconnection. For forward-looking simulations, Razor incorporates a US state-level cross-sectional, regression-based demand model for each of the three customer classes—residential, commercial, and industrial. Power system composite state indexes drive base year demand levels by customer class into the future.

Load modifiers

Utilization of some power supply resources is independent of SRMC–based dispatch dynamics. Some power supply is determined by out-of-merit-order utilization, normal production patterns, or external conditions—such as solar insolation levels, water flows, and wind patterns. These power supply resources are treated as load modifiers.

Net load

Net load is the difference between power system aggregate electric output needs and the aggregate supply from load modifiers. It is the amount of generation that must be supplied by dispatchable power supply resources.

Calibration of the inputs determining net load is possible using data reporting the aggregate output of dispatchable power sources.

Fuel- and technology-specific supply curves

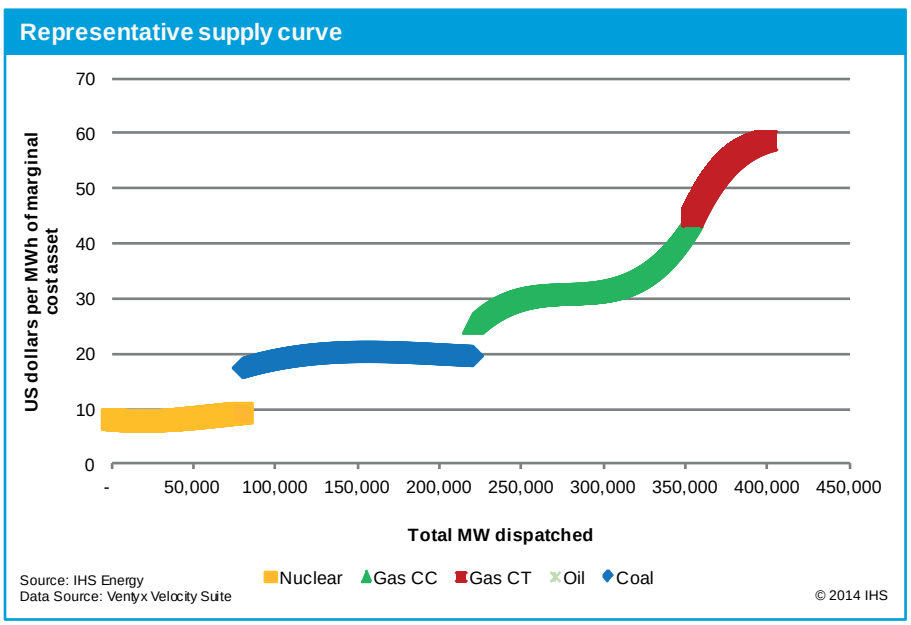
Supply curves are constructed for each fuel and technology type. The supply curve for each dispatchable power supply type reflects the SRMCs of the capacity across the possible range of utilization rates. Applying availability factors to installed capacity produces estimates of net dependable (firm, derated) capacity by fuel and technology type.

Each cost curve incorporates heat rate as a function of utilization rate.[14] *Heat rate* describes the efficiency of a thermal power plant in its conversion of fuel into electricity. Heat rate is measured by the amount of heat (in Btu) required each hour to produce 1 kWh of electricity, or most frequently shown as MMBtu per MWh. The higher the heat rate, the more fuel required to produce a given unit of electricity. This level of efficiency is determined primarily by the fuel type and plant design. Outliers are pruned from data to give a sample of heat rates most representative of the range of operational plants by fuel and technology type.[15]

Dispatch fuel costs are the product of the heat rate and the delivered fuel cost. Total dispatch costs involve adding variable operations and maintenance (VOM, or O&M) costs to the dispatch fuel costs. These O&M costs include environmental allowance costs.

The power system aggregate supply curve is the horizontal summation of the supply curves for all fuel and technology types. Figure B-1 illustrates the construction of the aggregate power system supply curve. The supply curve shows the SRMC at each megawatt dispatch level and the associated marginal resource.

FIGURE B-1



Balancing power system aggregate demand and supply

The Razor Model balances aggregate power system demand and supply by intersecting the demand and supply curves. At the intersection point, power supply equals demand; supply by type involves equilibrating the dispatch costs of available alternative sources of supply.

14. Power plant data sourced from Ventyx Velocity Suite.

15. Outliers are defined as plants with an average heat rate higher than the maximum observed fully loaded heat rate.

This power system–wide marginal cost of production is the basis for the wholesale power price level that clears an energy market.

The Razor Model results in the following outputs:

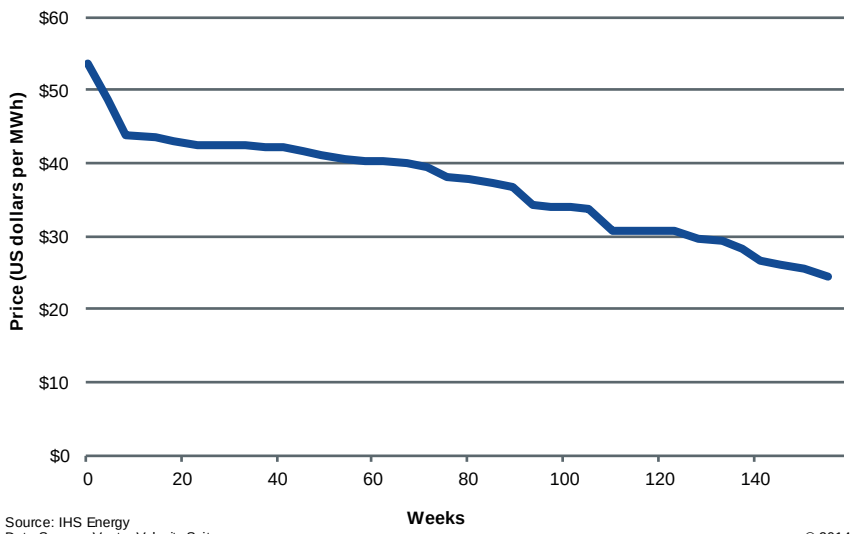
- **Power system SRMC/wholesale price**
- **Generation by fuel and technology type**
- **Average variable cost of production.** The average variable cost is calculated at each dispatch increment by taking the total cost at that generation level divided by the total megawatt dispatch.
- **Price duration curve.** The price duration curve illustrated in Figure B-2 provides an example of wholesale power price distribution across the weeks from 2010 through 2012.

Calibration

The predictive power of the Razor Model for portfolio and substitution analysis is revealed by comparing the estimated values of the backcasting simulations to the actual outcomes in 2010–12.

FIGURE B-2

Representative price duration curve



Source: IHS Energy
Data Source: Ventyx Velocity Suite

The Razor Model backcasting results provide a comparison of the estimated and actual wholesale power prices. The average difference in the marginal cost varied between (3.8%) and +2.3% by interconnection region. A comparison of the average rather than marginal cost of power production also indicated a close correspondence. The average difference between the estimate and the actual average cost of power production varied between (4.7%) and (0.1%) by interconnection region. Table B-1 shows the assessment of the predictive power of the Razor Model for these two metrics across all three interconnections in the 2010 to 2012 weekly backcasting exercise.

TABLE B-1

IHS power system Razor Model analysis

	East	West	ERCOT
Average wholesale power price difference	2.3	0.3	-3.8
Average production cost difference	-0.2	-4.7	-0.1

Note: Differences reflect deviation averaged over backcasting period. Production cost difference reflects average of five power sources: Coal, gas combined-cycle, gas combustion turbine, nuclear, and oil.

Source: IHS Energy

The New York Times | http://nyti.ms/1i1vFJW

ENERGY & ENVIRONMENT

Coal to the Rescue, but Maybe Not Next Winter

By MATTHEW L. WALD MARCH 10, 2014

COLUMBUS, Ohio — When the temperature here dropped into the teens this winter, ice formed on the inside of Ernestine J. Cundiff's windows in the drafty 50-year-old apartment building where she lives. At 81, with diabetes, poor circulation in her legs and both shoulders damaged in separate falls last year, Ms. Cundiff said wearing leggings and fur-lined slippers was not enough to keep her warm, so she took to using an electric space heater in her bedroom.

Then came the electric bill, $96.75 in January, up about 50 percent from the previous month. That was in addition to a gas bill of $153.44, up from $106.12 the month before. "When I opened the bills, I thought I was going to have another heart attack," said Ms. Cundiff, whose only income is the $1,226 a month she receives from Social Security.

Like many other people this winter, Ms. Cundiff turned to a community service organization. Impact Community Action, a Columbus agency, enrolled her in a state program that holds energy bills to 6 percent of a person's income. Regina Clemons, the director of emergency assistance at Impact, said the group was on track to sign up 9,000 to 10,000 people this winter, compared with about 8,000 last winter.

"We find people who have never ever walked into a community action agency before, looking for help," said Carmen Allen, the community outreach coordinator.

As the end of the harshest winter in recent memory approaches, the bill is coming due for millions of consumers who are not only using more electricity and natural gas but also paying more for whatever they use. And there might

not be relief in future winters, as the coal-fired power plants that utilities have relied on to meet the surge in demand are shuttered for environmental reasons.

The sticker shock has been particularly acute in the Northeast, where natural gas supplies have been constrained. But it has spread to other regions of the country, including the Midwest, where utilities have had to draw on more expensive reserves to meet the demand.

In Pennsylvania, Attorney General Kathleen G. Kane said her office had been flooded with complaints from consumers whose utility bills had soared, in some cases tripling. In Rhode Island, the utility National Grid received permission for a 12.1 percent electricity rate increase in January, nearly all of it because of higher prices for the gas used to make electricity.

In New York, Con Edison increased the price of each kilowatt-hour about 16 percent this month compared to last year. And in Ohio, energy retailers will demand higher prices from customers like Ms. Cundiff when annual contracts are renewed.

Underlying the growing concern among consumers and regulators is a second phenomenon that could lead to even bigger price increases: Scores of old coal-fired power plants in the Midwest will close in the next year or so because of federal pollution rules intended to cut emissions of mercury, chlorine and other toxic pollutants. Still others could close because of a separate rule to prevent the damage that cooling water systems inflict on marine life.

For utilities, another frigid winter like this one could lead to a squeeze in supply, making it harder — and much more expensive — to supply power to consumers during periods of peak demand.

Senator Lisa Murkowski of Alaska, the ranking Republican on the Senate Energy Committee, told utility regulators in a speech on Feb. 11 that the recent frigid weather had provided "a glimpse of the challenge that lies ahead." American Electric Power, which serves Columbus and a vast area of the Midwest, was running 89 percent of the coal plants that it must retire next year, she said.

"That raises a very serious question," she said. "What happens when that

capacity is gone?"

The coal plants are dirty, and expensive compared to natural gas at summertime prices. But coal is far less prone to price jumps or to shortages, and in a cold snap, it looks like a bargain. Without the coal plants, experts agree, prices in the peak periods of winter and summer will be higher, so future periods of cold weather may be even harder on electric bills.

"We are seeing unprecedented amounts of coal units retiring," said Andrew L. Ott, a senior vice president at PJM Interconnection, the grid operator that covers Pennsylvania, New Jersey and Maryland and has expanded into West Virginia, Ohio and adjacent areas.

"No doubt this industry is in a massive transition," he said, adding that the change would be accompanied by more price volatility.

PJM recently set a peak record for winter energy use of about 140,000 megawatts. Its summer record is 168,000 megawatts. Plants that use coal, with a combined capacity of about 12,000 megawatts, are retiring. Enough capacity is available, and new gas-fired units are being built, but while gas production has kept up with consumption, pipeline capacity has not.

In some cases, the Environmental Protection Agency has reduced the disruption caused by retirements by delaying deadlines, to give utilities more time to comply with its rules or to get alternate arrangements in place. But American Electric Power executives say that will not be the case this time, because even with a reprieve from Washington, citizens could bring lawsuits under the Clean Air Act that would force the closures.

What's more, many plants are far along the path to retirement. At Muskingum River, a five-boiler coal plant in Beverly, Ohio, about 100 miles southeast of Columbus, three of the units ran during the so-called polar vortex, supplying power to meet the demand.

But three-quarters of the 400 or so employees the plant had two years ago are gone, and two of the five units need half-million-dollar repairs to run again, an expensive proposition for a plant that is scheduled to close and runs only intermittently.

American Electric Power has stopped hiring at other plants that are scheduled to remain in service, to make space for employees who would like to

transfer. Units 1 and 2 at Muskingum River, commissioned in the early 1950s, cannot run anymore because they both need a new lining in the floor of their boilers, at a cost of about $500,000 each, and there would be no time to recoup the investment. Unit 5, the youngest, commissioned in 1968, was a candidate for continued use, but it would need upgrades to reduce pollution that would cost hundreds of millions of dollars. Lately the plant has run only on very hot or very cold days.

The plants set to be closed will not be replaced by newer, cleaner coal plants, and a number of new gas plants are planned or under construction. The average price of natural gas is too low to let coal compete, and new rules loom for carbon dioxide emissions from new coal plants. And it is not only coal that is disappearing from the mix. Nuclear energy is, as well. Last year the energy company Dominion closed its Kewaunee reactor in Wisconsin, which had been running smoothly and without opposition but could not produce power at a competitive rate in the Midwest electricity market. Another energy supplier, Entergy, announced that it would close Vermont Yankee, a nuclear power station in Vernon, Vt., because the cost of production was higher than the market rate for power. In both cases, the main challenge was natural gas, which has remained cheap apart from the recent price surges.

Marvin Fertel, the president of the Nuclear Energy Institute, the industry's trade association, told Wall Street analysts on Feb. 13 that the gas crunch illustrated the need for diverse sources of energy.

"Risks are lower with diverse portfolios," he said, but the competitive market does not reward diversity. Nor does it reward a coal plant with a supply of fuel that could last weeks in a pile nearby, or a reactor with 18 to 24 months of fuel in its core, he said.

At the Muskingum River coal plant, there was resignation and uncertainty. Muskingum will be "dispositioned," in the new jargon, while other plants, with more antipollution equipment, have been designated "keepers." The plant opened six years before Craig Douglass, 54, was born, and Mr. Douglass, an outage coordinator who has worked there for 33 years, said of the people who built it, "I don't think they ever imagined they'd be running that long."

Mr. Douglass is going to a "keeper" plant. Others are retiring. In the control room one recent afternoon, there was an odd mix of crisp, modern computer screens and control panels that looked as if they had been borrowed from a 1950s science fiction film. Michael Stehly, 55, a supervisor, clearly did not want to operate either.

"I might be the guard at the gate," he said, "who lets the scrap metal trucks in and out."

A version of this article appears in print on March 11, 2014, on page B1 of the New York edition with the headline: Coal to the Rescue, This Time.

QUESTIONS FOR THE RECORD
The Honorable Lamar Smith (R-TX)
U.S. House Committee on Science, Space, and Technology

EPA's Carbon Plan: Failure by Design

Wednesday July 30, 2014

Responses from Jeff Holmstead (in italics below)

1. The Clean Power Plan, which EPA released as part of President Obama's Climate Action Plan, relies on the Agency's authority under Section 111(d) of the Clean Air Act. Based on your experience as Assistant Administrator for EPA's Office of Air and Radiation, can you [identify] what other rules that EPA has issued under this same provision – section 111(d)?

There are only five types of "sources" that have been regulated under Section 111(d). EPA has used this section:

1. *To regulate acid mist from sulfuric acid plants*
2. *To regulate flourides from Phosphate fertilizer plants*
3. *To regulate flourides from Primary aluminum plants*
4. *To regulate total reduced sulfur from Kraft pulp plants*
5. *To regulate landfill gases from Municipal solid waste landfills.*

a. Was the Agency's approach in developing the Clean Power Plan consistent with these previous rulemakings? (Including recent 111(b) regulations recently and concurrently proposed)?

The Agency's approach in the proposed Clean Power Plan is altogether different from anything it has done in these other regulations and goes well beyond the authority that Congress has given EPA under the Clean Air Act. It is also inconsistent with the approach that EPA has proposed for new power plants under Section 111(b). The key differences are discussed below.

b. If not, could you explain how they differ and whether this inconsistency could have legal ramifications?

The five regulations listed above fall squarely within EPA's authority under the Clean Air Act because they required states to set a "standard of performance" for each source of this type that was located within their borders. Under these regulations, each source must comply with an allowable emission rate that can be achieved by using the "best system of emission reduction" that achieves a "continuous emission reduction" from that type of facility.

There are only five 111(d) regulations because Section 111(d) can only be used for pollutants that are not regulated under other parts of the Clean Air Act. Virtually all other pollutants are regulated as either "criteria pollutants" or "hazardous air pollutants," so they cannot be regulated under 111(d)

Several environmental groups have argued that, because there is so little precedent under 111(d), EPA is essentially drawing on a blank slate and can be very creative. But this is

misleading because EPA has interpreted the relevant language of the statute dozens of times for many different pollutants from new sources.

Under Section 111, EPA is required to set a "standard of performance" for new plants under Section 111(b), and, under certain circumstances states are required to set a "standard of performance" for existing plants under Section 111(d). The relevant statutory language is the same – a "standard of performance."

Until now, a standard of performance has always been an emissions rate that can be achieved by the "best system of emission reduction" that "has been adequately demonstrated" for controlling emissions at the type of plant being regulated. So, for example, EPA has proposed a standard of performance for carbon emissions from new coal-fired power plants of 1,100 lbs per megawatt hour, based on the use of CCS, which EPA believes has been adequately demonstrated.

For existing power plants (but not new one), EPA is now taking the position that the standard of performance does not apply to an individual plant, but to the whole "electricity system" in a state. This is inconsistent with how EPA has defined "standard of performance" for more than 40 years. It is also inconsistent with the standard of performance they have proposed for new coal-fired plants. If EPA really believes that "beyond the fence line" actions can be used as a standard of performance, it could achieve much great reduction in carbon emissions from new plants at a lower cost by allowing new plants to invest in energy efficiency and demand response programs rather than CCS.

EPA justifies its proposed 111(d) approach based on a statutory provision that defines a "standard of performance" as "a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."

EPA focuses on the word "system," which is certainly a broad term. And the statute does define a standard of performance, in part, as "the degree of emission limitation achievable through the application of the best system of emissions reduction." The statute also provides that this system must ensure a "continuous emission reduction" from a source being regulated. But the key legal question in this case is not what a "system" may be. The statute says that a standard of performance must be based on "the ***application*** *of the best system of emission reduction." In this case, the question is "the application of the system to what?" EPA says, "to anything that produces or uses electricity." But the answer, according to the statute and almost 40 years of regulatory history, is "the type of facility being regulated." In the context of Section 111(d), this means to "any existing source," as long as it ensures a "continuous emission reduction" from that source and that, "in applying a standard of performance to any particular source," the state is able to "take into consideration, among other factors, the remaining useful life of the existing source to which such standard applies."*

2. Administrator McCarthy recently said that EPA sees its Carbon Plan as "an opportunity to look at a short-and long-term investment strategy, not a pollution control strategy."

a. Do you believe that Congress authorized EPA to oversee investment strategy for the electric sector?

Congress never authorized EPA to impose or oversee a new investment strategy for the power sector. Nor has it authorized EPA to set a statewide carbon emission rate based on EPA's view as to how that state should restructure its electricity system and reduce the demand for electricity. Under Section 111(d), EPA is authorized only to require states to establish a standard of performance that applies to individual plants.

b. Administrator McCarthy also recently said that is Carbon Plan can be complied with "in ways that are very far from pollution control technologies." Isn't this precisely why Congress required that these regulations be based "inside the fence-line" – so that EPA doesn't end up regulating things beyond what a specific rule covers?

In the Clean Air Act, Congress gave EPA the authority to implement a number of different regulatory programs. When it implements these programs, EPA must follow the approach that Congress intended. Under Section 111(d), EPA may require states to set a "standard of performance" for certain types of existing sources, but EPA may only require a state to set standards that will continuously control emissions at a source when that source is operating. It does not have authority to set statewide standards based on EPA's views as to how a state should change its electricity system.

3. Do you believe EPA has the authority, under a CAA section 111 rule regulating fossil fueled power plants to issue a federal implementation plan that orders a state to generate electricity from renewable sources not regulated by the rule?

No. EPA does not have authority to require that renewable generating sources be constructed or used. Such requirements can be imposed by states but not by EPA or any other federal agency.

a. Do you believe EPA has the authority to issue a federal implementation plan that dictates how electricity is dispatched in a state?

EPA does have authority to require power plants to install demonstrated pollution control technology. Regulations such as MATS and CSAPR impose requirements that make certain coal-fired power plants more expensive to operate and thus have an impact on dispatch. However, EPA cannot simply mandate changes in dispatch as it has tried to do in its 111(d) proposal. EPA is attempting to take a certain amount of business from coal-fired power plants and transfer it to combined cycle natural-gas fired plants. Congress never gave EPA authority to mandate this type of "environmental dispatch."

b. Do you believe EPA has the authority to issue a federal implementation plan creating federally enforceable building efficiency codes?

No. Again, it is clear that EPA does not have this authority. It can only implement the statutory authority it has received from Congress, and Congress has never given EPA authority to impose building efficiency codes or any other type of end-user efficiency mandates.

c. Do you believe EPA has the authority to issue a federal implementation plan that orders states to require nuclear power plants operate?

No. EPA does not have authority to require any type of power plant to operate or to require that a certain amount of a state's electricity be obtained from any particular generating facility or type of facility.

d. Do you believe EPA has the authority to issue a federal implementation plan that orders states to reduce electricity use by 1.5% each year?

No. EPA simply does not have authority to impose requirements to reduce the demand for electricity.

4. In addition to claiming flexibility, EPA has said the proposal reflects "the important role of states as full partners with the federal government in cutting pollution." However, each State Plan must still be reviewed and approved by EPA.

a. If a state legislature creates an energy efficiency or renewable energy program and later determines that is not in the best interest of the state, can the legislature go back and change the programs it has created.

Under current law, a state legislature is free to change any type of energy efficiency program or renewable energy mandate that has been put in place in that state. This would no longer be the case if EPA's proposal is adopted. Under the proposal, if EPA has approved a state 111(d) plan that includes a renewable energy mandate or end-user efficiency program, the state legislature cannot change those programs without approval from EPA. If a state legislature does try to change such programs without EPA approval, EPA and environmental activists would still be able to enforce the original programs even if they had been rescinded by the state legislature.

b. Is there currently adequate oversight to ensure there is no discrimination against specific states? For example, some states and localities have worked to attract industry and importantly, good paying jobs through low energy costs.

As noted above, EPA's proposal would require each state to change its electricity system based on EPA's view of how electricity should be generated and used in each state. Generally, states that have been able to keep electricity prices low have chosen to rely primarily on coal-fired generation. This would no longer be possible under EPA's proposal, as all states would have to shift away from coal and adopt requirements that would increase the cost of electricity.

c. Does EPA have the authority under Section 111(d) to impose its own regulations on utilities if a state's plan is deemed to be insufficient to meet EPA's CO2 reduction level? Who makes this determination?

Under the Clean Air Act, EPA does have authority to impose a federal 111(d) plan in a state if the state fails to adopt a "satisfactory" 111(d) plan of its own. EPA makes the determination as to whether a state plan is satisfactory. However, there are serious legal questions as to whether EPA could adopt a plan that contains all the measures it wants states to adopt. I cannot think of any Clean Air Act provision, for example, that would authorize EPA to change the way power

plants are dispatched, to impose renewable energy mandates, or to create programs to reduce power demand.

5. Is there any particular section or authority in the Clean Air Act that gives the EPA the power to eliminate the use of a particular fuel?

No. Congress has not given EPA authority to eliminate any type of fuel. EPA can require plant owners and operators to use the best system of emission reduction that has been adequately demonstrated to control emissions from a plant burning coal, or a plant burning natural gas, or a plant burning petcoke, but it cannot prohibit anyone from building any particular type of plant. Nor can it mandate a shift from one fuel to another at existing plants

6. The Federal Power Act has long prevented the federal government from interfering with state management of intrastate electricity matters. Yet, under the proposed Carbon Plan, EPA would have to approve how states operate their respective electricity systems.

a. This proposal overturns nearly a century of state flexibility on electricity matters – is EPA's plan really providing "flexibility" for states?

As a legal matter, EPA's proposal would provide states with flexibility to meet EPA's mandated statewide emission rates in any way they choose. As a practical matter, however, states would have very limited flexibility. Given the proposed timeframes and emission reduction requirements, most states would effectively be required to adopt the measures that EPA has used to calculate each state's emission rate. In fact, based on conversations with a number of state and power sector officials, it may not be possible for some states to meet EPA's proposed near-term requirements at all.

b. The federal Power Act Restricts FERC authority to interstate electricity transmission and wholesale electricity prices, and leaves electricity generation and intrastate distribution to the States. Yet the proposed Carbon Plan short-circuits this separation, and places EPA in control of intrastate electricity matters. Under what legal authority is EPA claiming authority over the grid that Congress didn't even give to FERC?

EPA claims to have discovered such authority in a provision of the Clean Air Act that has been in place for almost 40 years -- Section 111(d). I do not believe the courts will uphold EPA's new interpretation of Section 111(d), which would give EPA rather breathtaking new authority to require states to change the way that electricity is generated and used within their borders. As the Supreme Court said in its recent decision in UARG v. EPA, another case involving EPA's authority to regulate carbon emissions:

> *When an agency claims to discover in a long-extant statute an unheralded power to regulate 'a significant portion of the American economy,' Brown & Williamson, 529 U. S., at 159, we typically greet its announcement with a measure of skepticism. We expect Congress to speak clearly if it wishes to assign to an agency decisions of vast 'economic and political significance.'"*

QUESTIONS FOR THE RECORD
The Honorable Kevin Cramer (R-ND)
U.S. House Committee on Science, Space, and Technology

EPA's Carbon Plan: Failure by Design

Wednesday July 30, 2014

Responses from Jeff Holmstead (in bold type below)

1. In the proposed rule, it seems to me the EPA is assuming electricity is generated and delivered only within one state. How does the EPA in the proposed rule address, for example, renewable electricity produced in one state but then delivered in another?

This is one of the issues that many outside parties have asked EPA to address. It now appears that EPA may allow a state to "take credit" for renewable energy generated in another state if there is an acceptable program for tracking "renewable energy credits" or RECs. It is unclear, however, whether this would be permissible under the Clean Air Act. Another similar problem arises when a state creates an end-user energy efficiency program that reduces demand at fossil-fuel power plants in another state. Under EPA's proposal, the state that created the program would not get any credit for it that would apply to the state's carbon reduction requirement. Such a program would only benefit the state where the power plant is located.

2. What kind of challenges does this impost on regulators trying to write a state implementation plan?

These issues are well discussed in a white paper prepared by the energy consulting firm of Wilkinson, Barker, and Knauer, entitled "State Implementation of CO2 Rules: Institutional Issues with State and Multi-State Implementation and Enforcement." This paper has now been provided to the Committee by one of the authors, Greg Sopkin, who testified before the Committee at the July 30th hearing. This white paper does a good job of discussing the practical issues facing state regulators trying to develop a 111(d) plan that would be satisfactory to EPA.

3. What authority does the EPA have, or a state for that matter, to regulate electricity demand, as proposed in one of the EPA's building blocks?

Some states have authorized a state agency or commission to impose programs designed to reduce the demand for electricity. This type of authority can only be granted by the state legislature. Neither EPA nor any other federal agency has authority to regulate the demand for electricity.

4. In your experience, is the timeline that the EPA has proposed feasible? One-year for development of state implementation plans, two-years if developing a regional plan?

I think even EPA recognizes that these timelines are not be feasible in most cases. In most states, as discussed in the Wilkinson, Barker, and Knauer White Paper, the State legislature will need to adopt new legislation to give a regulatory agency or commission the authority to impose the

types of programs envisioned by EPA's various building blocks. Assuming that such legislation is adopted, then state agencies or commissions will need to deal with a number of different stakeholders to develop a proposed 111(d) plan, including detailed regulations, that complies with the state legislation and will satisfy EPA. All states have some type of administrative procedure act that would require such a proposal to be published for public comment. Then, after a public comment period, the implementing agencies would need to issue a final rule to impose the necessary regulatory requirements. It is simply not plausible that states would be able to accomplish all these steps, many of which will be very controversial, in one or two years.

1. Increasing efficiency by 6% (or by any percentage) is very arbitrary and not grounded in any science or engineering detail. It ignores the existing operating conditions and dynamic operation of the generation in a system. It also ignores the age of the unit and existing efficiency. Old units can improve much more than new efficient units so the logic of a percentage improvement is not sound.

   This regulatory target makes it nearly impossible for new, efficient units to achieve the targets and the old units that might have enough upgrade space to achieve 6% are likely to be less efficient than newer units, even with the upgrades.

   The other aspect of an arbitrary 6% associated with this Carbon Plan is the impact on these coal plants resulting from other rules and requirements – all of which will be additive to overall performance. And yet make it impossible to project or invest as the target continues to move.

   All that said, if a plant were to attempt to achieve the 6% and needed to design, engineer, construct and operate, a 5 – 7 year period to implement is reasonable. How long the 6% would be maintained would largely hinge on future regulatory requirements imposed. So who knows?

   This is a disingenuous target that is proposed and the EPA knows no coal-fired generator would pursue due to uncertainty of the investment. Especially true for new facilities (5-10 years old) that are already highly efficient, as a 6% improvement to the best units in the fleet is impossible with today's technology. And, by the way, any changes to existing units would expose the operator to a NSPR and no company wishes to expend the cost or be exposed to the uncertainty.

2. a. Natural gas pipelines – no
   b. Transmission electric wires – no
   c. System reliability (volts and vars for stability) – no

   My testimony highlighted the other agencies that could have been engaged to report findings – there are none.

3. Resource adequacy is a term that speaks only to installed capacity measured against anticipated demand. It does not factor in load variation, maintenance and reliability, weather anomalies, reserve margin requirements in existing service areas or by PUC's in states.

   In short, it is the least representative term that can be applied to reliable and dependable service and is far short of a sufficient term or analysis to meet the test of full disclosure. It also takes no account of delivered cost of electric service to customers.

4. Energy affordability and system reliability and security were not factored in any manner whatsoever.
   No studies.
   No projections.
   No effort to pursue any of this information.

Pursuit of study information would have produced inconvenient truths that were not pursued for obvious reasons. The facts would be compelling against the Rule 111(d) in that energy would be far less secure and much more expensive on average to the US customer. Worse yet, it would be especially injurious to the six states that bear 40% of the CO_2 reduction requirements. Manufacturing will become uncompetitive (as it is in most of the states that will not be as greatly impacted by the regulation) and customers in the six states will see their power bills increase by three and four times the current base.

5. a. I was not at DOE over the last year. My previous experience in the formulation of new coal plant regulations was what I referenced in terms of my previous experience with the EPA. That experience was that EPA did not request analysis – only a perfunctory review of "resource adequacy" – and that was done by DOE's policy office and not of my department of fossil fuels or the Office of Electricity.

   Yes, it would be helpful.

   It would show what I spoke of in the answer to question 4 above.

   b. There are a myriad of problems because the assumption is but one assumption. There are no scenarios on forward price or availability. Natural gas is assumed available everywhere – it's not. Natural gas price is constant – it will surely not be. In fact, prices and availability are assumed constant and no rational sound analysis would contemplate such scenarios.

   A business analysis requires scenario analysis aud probability of such scenarios occurring. A transparent finding must include the cases and performance expectations of the case and an honest call on cost and reliability that is inclusive of necessary investment. Analyzing jobs "gained" and ignoring any "jobs destructions" is also disingenuous.

   The DOE, Department of Commerce and other government agencies have access to internal and external sources of information that can truly inform the scenario analysis. There is no evidence that any information is provided or even sought after.

Cash Responses:

1. As we all know, my home state of Texas is a large state; producing the most electricity in the nation, which in turn makes it the largest carbon emitter in the nation. In 2011, Texas emitted 656 million metric tons of carbon dioxide, accounting for about 12% of the nation's total carbon emissions.

   The EPA's proposed clean power rule requires Texas to cut its carbon emissions by roughly 39% from 2005 levels by 2030. As you've outlined in your testimony Dr. Cash, there are different ways that your state of Massachusetts has gone about cutting carbon emissions. I think Texas has already taken steps in the right direction including becoming the first state to establish an Energy Efficiency Resource Standard requiring utilities to utilize end-use efficiency to reduce load growth; and investing in cleaner forms of power generation such as natural gas, which makes up 41% of our electrical generation. Wind energy in the state of Texas makes up 10% of our electrical generation and our state has the largest wind capacity in the nation, more than double our next state competitor.

   Is the state of Texas on the right path to complying with any final rule that the EPA comes out with and what other steps can we undergo to accomplish this goal?

1. Answer:

   Texas is on the right path for compliance. I don't know the specifics of the Energy Efficiency Resource Standard, but energy efficiency is by far the cheapest "fuel" for getting emissions reductions. In many states, aggressive energy efficiency programs have led to lower costs for residential and business customers that utilize the programs, and for all customers as electricity demand overall all declines leading to lower prices. This has also led to both greater reliability since the system is not stressed as much, and lower emissions of local air pollution and greenhouse gases. As you note, Congressman Veasey, Texas has definitely been a leader in wind energy, and therefore has shown that development of large-scale renewable resources can happen – providing benefits to the developer, land owners and creating clean energy jobs in Texas. I believe that the EPA rules will provide greater incentives for both energy efficiency and renewable energy that can be captured by Texas, creating economic benefits while lowering emissions.

2. One concern that I do have in regard to the EPA's Clean Power Rule is the possible effect on utility prices for consumers. According to the Energy Information Administration, Texas households have an average annual electricity cost of roughly $1,801, one of the highest in the nation. Given the EPA proposed rule estimates utility costs for consumers may rise, I am concerned for many of my constituents who currently struggle with energy costs.

a. Dr. Cash, in your testimony you stated when RGGI was originally developed, you predicted electricity rates to rise 1-2%, but instead they have dropped 8%. Can you explain what this drop may have possibly been attributed to?

b. How can we ensure, if this rule goes forward, that we protect consumers from rising electricity rates?

2. A.

The drop in electricity rates and bills in New England in the last several years has been attributed o several forces: greater supply of cheap natural gas that has been driven by the market; expansion of energy efficiency programs throughout the region, resulting in close-to zero load growth; greater deployment of wind and solar that has depressed forward capacity and real-time energy market prices.

2.B.

Aggressive energy efficiency programs help keep consumers' rates low. In addition, in the Regional Greenhouse Gas Initiative emissions trading programs, there are a variety of mechanisms like banking that help keep rates low. In addition, by auctioning allowances and returning those funds to consumers in the form of rebates/credits or energy efficiency programs, we are able to protect rate payers.

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September 1, 2014

BY EMAIL AND CERTIFIED MAIL

The Honorable Lamar S. Smith
Committee on Science, Space and Technology
2321 Rayburn House Office Building
Washington, D.C. 20515

Re: *EPA's Carbon Plan: Failure by Design Hearing*

Dear Representative Smith:

Thank you for the opportunity to participate in the Committee on Science, Space and Technology's hearing entitled "EPA's Carbon Plan: Failure by Design" on Wednesday, July 30, 2014.

I appreciate the questions submitted for the record by Members of the Committee and the opportunity to respond to them. Enclosed with this letter are my responses to these questions.

Please let me know if you or any other Member has additional questions, and thank you for the opportunity to provide testimony to the Committee.

Sincerely,

Gregory E. Sopkin

Enclosure

Responses to Questions for the Record
U.S. Committee on Science, Space, and Technology

EPA's Carbon Plan: Failure by Design

1. What is the problem with states enacting new laws that exercise resource planning jurisdiction over all EGUs- isn't this something they do now?

Many utilities, specifically rural electric associations or cooperatives and municipal utilities, are not subject to resource planning jurisdiction of state public utilities commissions. These entities self-determine their own resource plans based on cost, reliability, and public policy considerations. For example, when I served as Chairman of the Colorado Public Utilities Commission (CPUC), the CPUC had no rate or resource planning authority over Tri-State Generation and Transmission Association, Inc. (Tri-State), Colorado Springs Utilities, or the Platte River Power Authority. This regulatory architecture exists in Colorado today. Therefore, new state legislation would be necessary to bring these non-jurisdictional utilities under the resource planning jurisdiction of the relevant state utility regulator such that the CPUC would have approval authority over all generators and utilities in a state Section 111(d) plan. Colorado is a specific example of a state where such legislation would be necessary. Most, if not all, other states subject to EPA's proposed rule to regulate carbon dioxide emissions (CO_2 Emission Guidelines) face this same issue.

Beyond these legal issues, there are also practical issues and concerns associated with this potential jurisdictional expansion. Many cooperatives or municipal utilities have never submitted a resource plan before. Therefore, these entities may not have the resources to develop and litigate a resource plan on a tight timeline. Cost also factors into this equation, as developing and litigating resource plans can cost each utility hundreds of thousands of dollars – if not more. Cooperative and municipal utilities' ratepayers ultimately bear these increased compliance costs, from obtaining approval of the resource plan to building the necessary internal functions to develop a resource plan.

Attached to my responses please find a white paper I co-authored entitled EPA's CO_2 Rule and 18 States' Resolutions and Legislation. This is a follow-up paper to the white paper submitted along with my testimony and discusses state legislation and resolutions enacted pursuant to Section 111(d). Specifically, it analyzes the interaction of these state laws, which rightly assert state primacy under the statute, and EPA's proposed CO_2 Emission Guidelines.

2. EPA says that one of the options for states is to enter into a multi-state plan.

   a. Do you foresee any complications with states entering into a multi-state plan?

Yes. Page 46 of EPA's proposed CO_2 Emission Guidelines frames the four general criteria upon which the agency will evaluate and approve or disapprove as state plans under Section 111(d): "1) enforceable measures that reduce EGU CO2 emissions; 2) projected achievement of emission performance equivalent to the goals established by the EPA, on a timeline equivalent to that in the emission guidelines; 3) quantifiable and verifiable emission reductions; and 4) a

process for biennial reporting on plan implementation, progress toward achieving CO2 goals, and implementation of corrective actions, if necessary."[1]

This first criterion is most relevant in evaluating complications associated with multi-state Section 111(d) plans. State plans must be enforceable and the involvement of multiple states, particularly with an aggregated CO_2 performance goal, raises the question of how emission reduction measures are enforced as between states. States should specifically want interstate enforcement authority, i.e., the ability for State A to enforce the terms of the multi-state Section 111(d) plan against State B. Without interstate enforcement authority, State A leaves itself susceptible to any noncompliance on the part of State B or any other participating state, in which case all states involved in the multi-state plan and the actors in those states are subject to the Clean Air Act's significant criminal and civil enforcement regime.

In addition, the Clean Air Act does not allow for interstate enforcement. Research reveals only Clean Air Act provision that explicitly references interstate pollution abatement, Section 126. This statutory provision authorizes downwind states to petition EPA to take action against an upwind state source. It does not, however, authorize State A to enforce against a source in State B, and is silent on remedies as between states if and when state disputes arise.

Finally, interstate enforceability almost certainly demands state legislation and Congressional approval, as discussed in my answer to Question 7 below, because the Compact Clause of the U.S. Constitution is implicated and an interstate compact is required to allow for interstate enforcement.

b. The EPA refers to the carbon trading program of northeastern states called the Regional Greenhouse Gas Initiative (RGGI) as a good example of how states can enter into a multi-state plan. Do you agree that RGGI is a model that can be followed by all states?

No. Our review of the RGGI reveals fundamental legal problems with this model when EPA's four general approval criteria are applied to it. The major issue is enforceability. Where several states join together and are subject to an aggregate CO_2 performance goal, the measures to achieve that goal are likely not "enforceable measures" unless there is interstate enforceability. Absent interstate enforceability, states cannot depend on the reductions that each state commits to achieving. More importantly, as a matter of law EPA cannot improve a multi-state Section 111(d) plan that lacks interstate enforcement because it does not satisfy the agency's first approval criterion.

Because the RGGI lacks an interstate enforcement mechanism, no state has enforcement power over any other state and any state can leave the RGGI without sanction. States can and do leave the RGGI, and New Jersey serves as a recent, high-profile example. Therefore, any multi-state plan modeled on RGGI would not meet the basic requirement of the proposed CO_2 Emission Guidelines that measures in state plans must be enforceable. Under RGGI, if a state cannot comply with the emission limit or performance goal, it can simply leave the arrangement

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[1] *Environmental Protection Agency, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 34,830 (June 18, 2014).*

because the RGGI is implemented on a state-by-state basis pursuant to state law (in all states except New York). No terms of the RGGI commit states to continued participation for a fixed period.

Compliance brings me to an additional point. Up until recently, the RGGI CO_2 emission standard was much higher than actual emissions, hence it was easy to meet the standard. These high standards effectively eliminated any possibility of noncompliance. Moreover, because the RGGI states are not tethered together to an aggregated CO_2 performance goal, they operate independently of one another in achieving, or not achieving, compliance with applicable standards. The reductions mandated by EPA's proposed CO_2 Emission Guidelines are much more severe than the RGGI reductions, and states can be dependent upon one another to achieve compliance as a group. Therefore, the likelihood of interstate rivalries and legal disputes increases substantially, which illustrates the need for states to have interstate enforcement mechanisms. The RGGI model lacks this integral component, and therefore is neither approvable by EPA nor advisable for states to pursue.

3. In building block 2 of EPA's proposal, they assume that states can increase gas combined-cycle units to a 70% utilization rate. Do you have any concerns with the technical feasibility of this?

Yes. According to EPA, in 2012 the national average utilization rate for gas combined-cycle units was 46%, so this assumes a significant increase across the board in gas combined-cycle utilization.[2] Indeed, a recent presentation given by Southwest Power Pool shows that the NGCC capacity utilization rate for NGCC is below 30% on average in its footprint.[3] EPA simply assumes that the average utilization rate can be increased over 200% in SPP's region, but utilities cannot make this happen without massive new investment in infrastructure that cannot be completed within EPA's carbon reduction deadlines.

There are numerous reasons for low utilization rates of NGCC capacity, although the reasons will vary on a state-by-state and regional basis. Some of these reasons are:

(1) Running the natural gas combined-cycle unit is more expensive than running a coal unit but less expensive than building a new coal unit, so the combined-cycle unit is run on an intermediate and not a baseload basis;
(2) The utility does not have sufficient unit capacity rights to run the unit more;
(3) The utility does not have sufficient gas infrastructure or storage rights to run the unit more;
(4) The utility does not have sufficient electric transmission rights to take more power off the unit; or
(5) The unit was not designed to run at a 70% utilization and cannot do so without endangering the safety or reliability of the unit itself.

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[2] *79* Fed. Reg. *at 34,857.*
[3] *Southwest Power Pool, Missouri Public Service Commission Presentation, at 6 (Aug. 18, 2014) (hereinafter SPP MPSC PTT), available at https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=EW-2012-0065&attach_id=2015004160.*

EPA did not factor any of these considerations into its assumptions under building block 2.

It is also worth considering the practical consequences of the reasoning above. If the first reason listed above is why a particular combined-cycle unit does not have a 70% utilization rate, then electric rates will increase as the utilization rate increases and displaces a cheaper form of electricity. If the second or third reason applies, then either it is impossible to increase the utilization rate or new infrastructure must be built or new transmission rights obtained, both of which come at a high cost. To get a sense of the costs at issue here, gas infrastructure costs can run upwards of $5 million per mile.[4] High voltage transmission lines typically cost approximately $1 to $2 million per mile, excluding substation costs.[5] The planning, siting, permitting and construction process involved in both intra- and inter-state pipelines, transmission and generation facility projects is expensive and time-consuming. This process can take up to a decade or longer in some scenarios and the EPA proposed rule provides no compliance alternatives to accommodate this process.

Therefore, it appears that EPA has either ignored or downplayed the infrastructure challenges and economics that limit the capacity factors of existing combined cycle units. To be sure, under any of the scenarios detailed above, customers ultimately lose because of the unfeasible and inaccurate EPA assumption in building block 2.

4. Building block 3 in EPA's proposal assumes that states can increase reliance on renewable energy. The specific amounts EPA puts into each state's mandate is based on what some neighboring states have planned.

   a. Do you have any concerns with this approach?

Yes. Overall, different states have different quality and quantities of renewable energy available in their state, and it often differs even between neighboring states. This is a direct effect of the reliance of these technologies on natural resources, which are not allocated based upon state or regional borders. For example, all western states are grouped together, including California, Colorado, Montana, Nevada, and Washington. The wind, solar, and geothermal resources in each state differ markedly and some states have legislatively mandated renewable portfolio standards (RPS) and some do not. California and Colorado's RPS percentage is double that of Arizona, Montana and Washington. Idaho and Wyoming have no RPS. These state laws drive the amount of renewable energy penetration in each respective state along with the amount of resources that are available. Notwithstanding these different drivers and nature of resources available, EPA averages them and imposes an assumption on each region. In some sense, citizens of one state are indirectly having the will of the citizens of another state applied imposed upon them, e.g., the imposition of Colorado's RPS statute on Wyoming residents.

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[4] *Dean Ellis, Managing Director – Regulatory Affairs, Dynegy, Illinois Commerce Commission US EPA Clean Power Plan Policy Session, Presentation at Illinois Commerce Commission 111(d) Stakeholder Meeting (August 18, 2014).*

[5] *See SPP MPSC PPT, at 13.*

In addition, expanding renewable energy requires building new or upgrading existing high-voltage transmission lines. According to SPP, for additional electric transmission it "[t]akes up to 8.5 years to perform applicable planning processes and construct transmission upgrades."[6] Many transmission projects are subject to staunch opposition legally and politically, which further increase costs and the timeline. In addition, high voltage transmission lines typically cost approximately $1 to $2 million per mile, excluding substation costs.[7] The proposed timelines in the CO_2 Emission Guidelines for a state to submit a Section 111(d) state plan do not even remotely factor in the approval and construction timeline for this essential infrastructure. Nor are these costs considered in EPA's plan.

b. Did EPA undertake any specific studies of technical feasibility? Are there things that could be issues such as load pockets? Or reliability concerns?

I do not believe that EPA has adequately studied the technical feasibility of its building block 3 assumptions. Renewable generation is not the same as gas, coal, or nuclear generation. Coal, gas and nuclear are dispatchable on demand, whereas renewable resources, with a few limited exceptions, are not dispatchable resources. Generation that can be counted on to meet peak demand, i.e., dispatchable resources, is counted for purposes of calculating reserve margins, which are typically 15% or higher. Accordingly, EPA cannot simply assume that increased renewable generation will replace dispatchable generation from coal, gas, or nuclear resources. EPA appears to have done so, which raises significant reliability concerns in my view.

Presentations from affected entities at state-level meetings across the country illustrate these reliability concerns. For example, at an Oklahoma Corporation Commission Mr. Lanny Nickell, Vice President of Engineering at Southwest Power Pool (SPP), presented an overview of SPP's generation assets and the perceived impacts of 111(d) on Oklahoma and its broader territory.[8] With a 41% reduction target, the rule will have particularly profound impacts on Oklahoma, requiring a 30% increase in gas combined-cycle capacity factor, adding nearly 50% more renewables, and retiring over 3,000 MW of coal generation. The rule would also impact capacity margins across its territory. Generators currently operate with a mandatory 13.8% annual capacity margin requirement, which EPA assumes will decrease to 5% by 2020 and -3.8% by 2024. Of the 14 LSEs served, 9 would be deficient by 2020 and 10 by 2024. Moreover, the additional transmission upgrades would be expensive and time consuming. Like many others, SPP is concerned the timetable does not allow sufficient time for planning, siting, permitting, and constructing the necessary upgrades: "Transmission infrastructure needed to mitigate reliability issues and to support interconnection and delivery of new generation will likely not be available by the time it is needed to facilitate compliance with the EPA's regulations."[9]

SPP is in the process of conducting a reliability analysis, with initial results expected any day, as well as an analysis comparing state vs. regional approaches. However, "preliminary results

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[6] *See id., at 11.*
[7] *See SPP MPSC PPT, at 13.*
[8] *Lanny Nickell, Vice President – Engineering, Southwest Power Pool, Oklahoma Corporation Commission Presentation (Aug. 21, 2014), available at http://www.occeweb.com/DEQ-EPA-Presentations.html.*
[9] *See id.*

indicate increased thermal overloads and low voltages due to EPA's assumed retirements," which will likely create challenges for meeting applicable reliability standards.[10]

c. Do EPA cost estimates consider the entire cost of new renewables, or does EPA assume that tax payers will continue to provide subsidies for wind and solar production? Is the full cost of these subsidies included in EPA's calculations?

EPA has not performed any kind of state-by-state analysis of costs, so I cannot test their cost assumptions. However, I would note that cost appears to be of little to no concern to EPA in this rulemaking, as it does not allow any exceptions to meeting its carbon standard based on cost or increased customer rates. At a Missouri Public Service Commission (Missouri PSC) workshop on August 18, 2014, Ameren Corporation indicated the likelihood of substantial increased customer rates as a result of the proposed CO_2 Emission Guidelines – and not an insignificant increase at that.. Ameren (a utility with approximately 1 million customers in Missouri) projects a $4 billion increase in costs as a result of EPA's proposed action.[11] *With costs like that from only a single entity subject to the rule, as a former regulator I do not understand how EPA can justify its complete disregard for costs and customer impacts in designing its proposed rule.*

5. EPA claims existing state structures can simply be "extended" to implement the Carbon Plan. Can EPA's plan to regulate, in its words, "from plant to plug" simply be grafted on to preexisting state or regional programs?

No. In fact, EPA takes conflicting positions on the issue of the compatibility of existing state structures and authorities with what is required under the proposed CO_2 Emission Guidelines. For example, in its Technical Support Document (TSD) entitled State Plan Considerations, EPA provides:

> *[A]n enforceability consideration is whether an IRP, and related public utility commission orders, must include additional requirements to implement certain actions, beyond denial of rate recovery or a change to utility tariffs if a utility fails to meet specified obligations in the IRP. If so, this may require state legislation to provide additional authority to state public utility commissions in some states, or confer additional authority to other agencies (e.g., a state environmental agency).*[12]

Accordingly, EPA is clearly contemplating that the authorities provided to state public utilities commissions and/or environmental agencies under existing state law are inadequate to implement key components of a Section 111(d) state plan. The excerpt above relates to utilities or generators already subject to some level of public utilities commission jurisdiction. As discussed in response to Question 1, there are additional and even more significant enforcement

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[10] *See id.*

[11] *Ameren Missouri, Missouri Public Service Commission Presentation (Aug. 18, 2014), available at https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=EW-2012-0065&attach_id=2015004151.*

[12] *EPA Office of Air and Radiation, State Plan Considerations – Technical Support Document for Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, at 15-16, Docket ID No. EPA-HQ-OAR-2013-0602 (June 2014), available at http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-state-plan-considerations.pdf.*

issues with regard to cooperatives and municipal utilities. Again, EPA recognizes this in its State Plan Considerations TSD:

> *Under a utility-driven portfolio approach, the entire suite of obligations under the plan would be enforceable against the utility company, which would also be an owner and operator of affected EGUs. If there are other affected EGUs in the state that are not owned and operated by a vertically integrated utility, a state plan might need to include other measures that address CO_2 emission performance by these affected EGUs.*
>
> *A similar approach could be taken by municipally owned utilities or utility cooperatives, which often also engage in an IRP process. However, state public utility commissions (PUCs) often do not regulate these utilities. As a result, implementation of a portfolio approach by these entities would introduce practical enforceability considerations under a state plan.*[13]

Given these jurisdictional and enforcement issues, and the fact that they are recognized by EPA, EPA's notion that state structures can be "extended" is alarming as a matter of law. Any "extension" of state agency authority requires the blessing of the legislature, and I believe that legislation is required in the states to implement this rule with enforceable measures.

6. A number of states have worked over the past decade to "de-regulate" their electricity markets. Would EPA's Carbon Plan effectively re-regulate electricity in those states?

Yes, the proposed CO_2 Emission Guidelines may ultimately result in a degree of soft reintegration of the utility function in restructured states. These states opted for competitive generation as a means to lower costs and achieve optimal resource mixes through competition instead of centralized resource planning by state utility commissions or similar entities. The proposed rule, however, necessarily reintroduces a central planning aspect to generation because allowable facilities must now be approved through the regulatory process and portfolios must be balanced by each state. There is no integrated resource planning process in these states, and therefore EPA takes the position that "[a] state-driven portfolio approach" is most suitable for restructured states.[14] *A state-driven portfolio approach is described as follows:*

> *Under a state-driven portfolio approach a mix of entities might have enforceable obligations under a state plan. This includes owners and operators of affected EGUs subject to direct emission limits, as well as electric distribution utilities, private or public third-party entities, and state agencies or authorities that administer end-use energy efficiency and renewable energy deployment programs or are subject to portfolio requirements.*[15]

Accordingly, entities ranging from generation owners to state agencies to even non-profits could be subject to an overarching regulatory scheme to achieve the applicable CO_2 performance goal. In the words of EPA:

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[13] *See id., at 11-12.*
[14] *See id., at 9.*
[15] *See id., at 10.*

> *One likely state plan scenario involves inclusion of enforceable obligations for state-regulated entities other than affected EGUs. An example of a state-regulated entity that is not an owner or operator of affected EGUs may be an electric distribution utility. These entities are typically regulated by a state public utility commission. An example of an enforceable state plan measure that might apply to an electric distribution utility is a compliance obligation under a state end-use energy efficiency resource standard (EERS) or renewable portfolio standard (RPS), or implementation of incentive programs for the deployment of end-use energy efficiency and renewable energy technologies.*[16]

The new regulatory architecture needed in restructured states, as outlined above by EPA itself, is tantamount to the "re-regulation" of electricity in these states.

7. Could states implement a multi-state plan under the Carbon Plan without approval from both state legislatures and Congress?

As discussed, I believe state legislation is required in all states, whether the state pursues an individual Section 111(d) state plan or a multi-state Section 111(d) plan. The necessary regulatory institutions and authorities simply do not exist. With regard to Congressional approval, the U.S. Constitution expressly addresses what amounts to contracts between individual states. Article I, section 10, clause 3 of the U.S. Constitution provides that "[n]o State shall, without the consent of Congress ... enter into any Agreement or Compact with another State." Interstate compacts can create enforceable obligations between parties, and the U.S. Supreme Court has held for nearly 200 years that compacts are contracts between individual states. The multi-state enforcement issues described in my responses to Questions 2(a)-(b) lead to the conclusion that a contract, in the form of an interstate compact, would be necessary to implement an enforceable multi-state Section 111(d) plan that allows states to enforce rights against one another to achieve compliance with the multi-state CO_2 performance goal.

Congressional approval is required for some but not all interstate compacts. Section VI of the white paper I co-authored (and submitted into the record along with my testimony) analyzes the issue of whether Congressional approval is necessary where states enter into an interstate compact. I believe it is very likely that a multi-state Section 111(d) plan with an interstate enforcement mechanism requires Congressional approval, and I am even more certain that if a group of states tries to proceed without such approval the states will be subject to protracted and expensive litigation.

8. The Federal Power Act has long prevented the federal government from interfering with state management of intrastate electricity matters. Yet, under the proposed Carbon Plan, EPA would have to approve how states operate their respective electricity systems.

   a. This proposal overturns nearly a century of state flexibility on electricity matters- is EPA's plan really providing "flexibility" for states?

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[16] *See id., at 14.*

No. In my view, "flexibility" is a talking point to mask what the proposed CO_2 Emission Guidelines actually are, i.e., a top-down mandate to implement a federal energy policy that has not and could not garner Congressional approval. This is troubling as an overall matter of democratic governance. Moreover, EPA's intrusion into state power over the electricity system raises substantial constitutional issues under the Tenth Amendment's reservation of local regulatory powers to the states.

From a Clean Air Act perspective, the proposed CO_2 Emission Guidelines obviate the state primacy inherent in Section 111(d) and the principle of cooperative federalism. The Oklahoma Attorney General's Plan, authored by Oklahoma Attorney General Scott Pruitt, concisely and properly construes Section 111(d):

> *EPA designs a procedure and emission guidelines, and States determine the legally enforceable emission standard that is as stringent as the applicable guideline – unless the State determines that circumstances justify imposition of a less stringent emission standard after evaluating the factors set forth at 40 C.F.R. § 60.24(f). More simply, the standard must satisfy the guideline unless enumerated circumstances, in the States' estimation, exist. This invokes the principle of cooperative federalism, with roles clearly delineated for both EPA and the States.*[17]

The proposed CO_2 Emission Guidelines do not comport with the statute or federal implementing regulations. EPA has provided no allowance for states to have a role in setting the carbon standard. The proposed rule states that Section 111(d) state plans or SIPs must achieve "emission performance equivalent to the goals established by the EPA, on a timeline equivalent to that" in the rule.[18] *The proposed rule offers no flexibility for a less-stringent standard or longer compliance timeline based on such factors as cost, reliability, or effect on ratepayers or the economy. EPA clearly rejected the case-by-case exceptions described in the federal implementing guidelines (40 C.F.R. § 60.24(f)) in its proposed rule:*

> *The EPA therefore proposes that the remaining useful life of affected EGUs, and the other facility-specific factors identified in the existing implementing regulations, should not be considered as a basis for adjusting a state emission performance goal or for relieving a state of its obligation to develop and submit an approvable plan that achieves that goal on time.*[19]

Further, the proposed rule does not allow deviation from carbon reduction mandate by analyzing what is achievable inside the fence, i.e., at the source. EPA's "flexibility" refrain is an attempt to ignore this fundamental legal issue and reframe the discussion.

b. The Federal Power Act restricts FERC authority to interstate electricity transmission and wholesale electricity prices, and leaves electricity generation and intrastate distribution to the States. Yet the proposed Carbon Plan short-circuits

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[17] *E. Scott Pruitt, Attorney General, State of Oklahoma, The Oklahoma Attorney General's Plan: The Clean Air Act Section 111(d) Framework that Preserves States Rights, at 2 (April 2014), available at http://documents.nam.org/ERP/OK_AG_Pruitt_Plan_05.20.14.pdf.*

[18] *79* Fed. Reg. *at 34,838.*

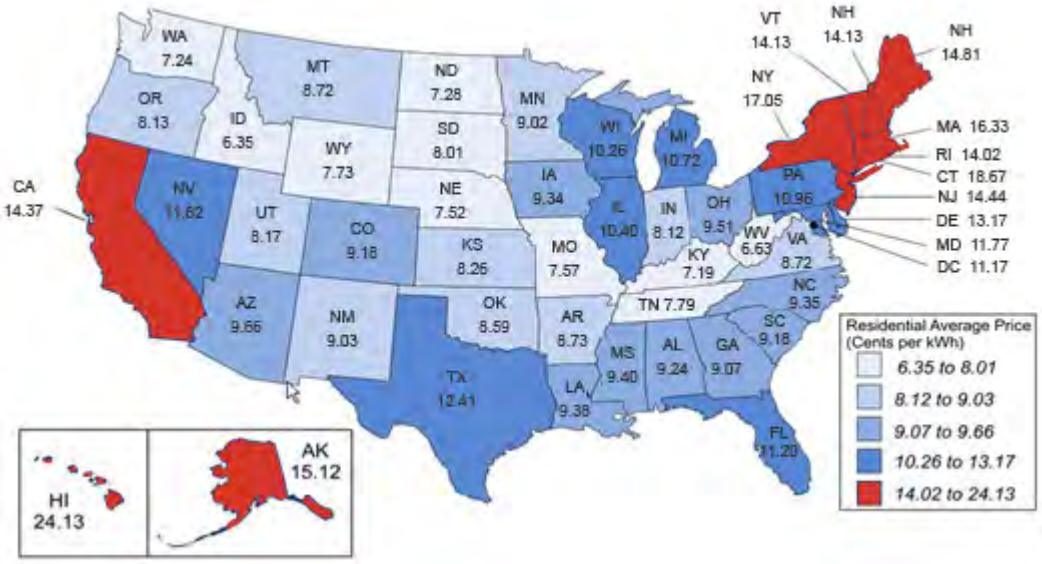
[19] *79* Fed. Reg. *at 34,926.*

this separation, and places EPA in control of intrastate electricity matters. Under what legal authority is EPA claiming authority over the grid that Congress didn't even give to FERC?

There is no such legal authority. EPA's proposal ignores Congress's clear bright line between state and federal jurisdiction over the electricity system. No federal agency has authority to impose the building block assumptions, e.g., environmental dispatch and demand reduction, that EPA used to set each state's carbon cap in its CO_2 Emission Guidelines. EPA's proposed de facto federal energy policy, and with it regulation of every element of the U.S. economy that impacts the generation, transmission, distribution and consumption of the electricity, eviscerates the regulatory compact that has been a foundation of utility regulation for over 100 years.

EPA's CO_2 Rule and 18 States' Resolutions and Legislation

EPA's Proposed CO_2 Rule Collides with Flexibility Asserted By States



August 2014

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Executive Summary

18 state legislatures passed either legislation or resolutions that EPA has rejected in its CO_2 Emission Guidelines. The states demanded that the EPA respect state primacy in setting performance standards under Section 111(d) and/or allow the state maximum flexibility to implement carbon standards, including allowing a more lenient standard and schedule based on the state's unique circumstances or cost or reliability factors.

EPA's CO_2 Emission Guidelines sets firm carbon reduction standards that must be met by each state beginning in 2020 and accelerating through 2030, and excludes "case by case" exceptions based on factors discussed in federal implementing regulations. These factors include: (1) unreasonable costs of control resulting from plant age, location, or basic process design; (2) the physical impossibility of installing necessary control equipment; or (3) other factors that make application of a less stringent standard or final compliance time significantly more reasonable.

The EPA CO_2 Emission Guidelines do not allow states to set their own carbon performance standards. This ignores the fact that states believe they have primacy pursuant to Section 111(d) in determining what standards should apply based on unique state circumstances.

According to EPA Administrator McCarthy, unless a state can show that EPA's data related to its four building block approach is flawed, EPA will not entertain a less stringent carbon reduction target. However, the state-specific data provided in EPA's proposed rule relates to meeting the carbon reduction standard, not cost or reliability. This does not afford states the opportunity to request EPA consideration of a less stringent standard based on cost or reliability factors.

The majority of states enacting resolutions or legislation regarding Section 111(d) would limit the carbon reduction standard to what is reasonably achievable inside the fence, i.e., at the EGU source. However, three of EPA's four building blocks reside outside the fence, and EPA's CO_2 Emission Guidelines do not allow for a state to deviate from its carbon reduction mandate by analyzing what is achievable at the source.

States have directed their environmental agencies to consider less stringent carbon reduction standards and compliance schedules based on cost; effect on electric rates, jobs, low-income populations, and the economy; effect on reliability of the system; engineering considerations; and other factors unique to the state. Based on language in the CO_2 Emission Guidelines, it does not appear that EPA will entertain variance requests that are based on any of these factors.

States that passed resolutions or legislation inconsistent with the EPA's CO_2 Emission Guidelines will not be able to comply with both legislatively-expressed declarations and EPA's mandate. EPA will either choose to revise its proposed rule to respect the rights asserted by the states, or reject these state assertions and invite litigation. States are then left in the impossible dilemma of ignoring state law to follow EPA's prescribed mandate, which would, by definition, be an illegal act by a state agency.

I. Introduction

In our earlier White Paper, "State Implementation of CO2 Rules," we discussed the significant institutional hurdles faced by states in implementing EPA's proposed rule to regulate carbon dioxide emissions (CO_2 Emission Guidelines) from electric generating units (EGUs). Briefly, we concluded:

- States will need to pass legislation to make it possible for state air regulators and utility regulators to implement the rule;
- Traditional non-state jurisdictional utilities will need to be made part of a unified "Carbon Integrated Resource Planning" (IRP) process;
- States pursuing a multi-state solution will need to enter into an Interstate Compact to make the rule enforceable, which will likely require congressional approval.

That White Paper of necessity elided some of the more nuanced state institutional questions embedded in the rule. Here, then, we embark on a follow-on series to explore some of those specific state issues.

The Opening Question for this Paper is:

How can states that have passed legislation or resolutions detailing how they will approach rule implementation "inside the fence" – and according to individual state policies, energy needs, resource mixes, and economic priorities – deal with EPA's proposed rule?

II. State Versus EPA-Defined "Flexibility"

On June 2, 2014, EPA issued its CO_2 Emission Guidelines under 42 U.S.C. § 7411(d) of the Clean Air Act (CAA) (Section 111(d)). Before that date, 18 state legislatures passed either legislation or resolutions[1] addressing the anticipated CO_2 Emission Guidelines. In virtually every case the legislatures requested or insisted that EPA respect state primacy in setting performance standards under Section 111(d), or allow the state maximum flexibility to implement carbon standards, including allowing a more lenient standard and schedule based on the state's unique circumstances, cost or reliability factors.

EPA effectively rejected these state requests and the notion of state primacy in its proposed CO_2 Emission Guidelines. The Guidelines set firm carbon reduction standards that must be met by each state beginning in 2020 and accelerating through 2030. The Guidelines also obviate the states' ability, promulgated in the Section 111(d) implementing regulations, to seek "case-by-case" exceptions (also called "variances") based on factors such as: (1) unreasonable costs of control resulting from plant age, location, or basic process design; (2) the physical impossibility of installing necessary control equipment; or (3) other factors specific to the facility (or class of facilities) that make application of a less stringent standard or final compliance time significantly more reasonable. Finally, EPA's proposed rule rejects the possibility of a less stringent standard or final compliance time.[2] Instead, the proposed rule requires that state Section 111(d) plans show "achievement of emission performance equivalent to the goals established by the EPA, on a timeline equivalent to that in the emission guidelines."

It is unclear whether EPA will revise its final rule to allow for these exceptions, or more lenient carbon reduction standards or compliance time. Initial signals from the agency are not promising. Robert Kenney, Chair of the Missouri Public Service Commission, asked the following question of EPA Administrator Gina McCarthy at the National Association of Regulatory Utility Commissioners (NARUC) Conference in Dallas on July 14, 2014: "If a state does its own modeling and determines that it can't reach the target at a reasonable cost, will the EPA entertain a less stringent target that is proposed by a state?" Administrator McCarthy's response in full is as follows (emphasis supplied):

> Well I think that what we did was, we tried to identify what we thought was reasonable and appropriate and get it one way, but allow the states every flexibility to get it in more creative ways. And by doing that we think we met the underlying requirements in the statute *so there wouldn't be a*

[1] As set forth below, five state legislatures passed bills that were signed by the governor, and thirteen state legislatures passed resolutions. Eight of these resolutions were passed by both the house and senate chambers, and five were passed by one of the two chambers.

[2] *See* EPA's CO_2 Emission Guidelines, at 520.

> *second opportunity to look at costs unless you think we blew the first analysis.* Okay, so it's really important, and I don't want to say this casually, it's really important to take a look at the underlying analysis for the states, take a look at it. Did we miss it, were the numbers not right? We've teed up a couple of alternatives which we're open to, because there's a lot here, and so take a look at it. There is two things to consider. One is, did we get this framing correct? But very importantly out of the gate is the data question. And so that's what led us to believe that we could do this in a way that was reliable and affordable, and the reliability and affordability of the electricity sector is not something that we're going to compromise. And so *we don't think it's required, we think there's ways in which we can move forward and we've shown that*. But if you see any problems with that data we really would like to see it soon and see if there's other things that we can consider.[3]

Administrator McCarthy's response strongly suggests that EPA will not entertain a less stringent target unless a state can show that EPA's data is flawed. Notably, the data provided by EPA in its proposed rule relates to the EPA's four "building blocks"[4] as one approach to meet the carbon reduction standard. However, EPA did not attempt to estimate the cost impact to any individual state in its CO_2 Emission Guidelines. Accordingly, there can be no "second opportunity" for a state to request EPA review of costs because EPA has not analyzed state-by-state costs as part of its "first analysis." Thus, a state showing that electric rates will substantially increase as a result of complying with EPA's carbon reduction mandate cannot be a basis for a less stringent standard or compliance schedule under the proposed rule.

If a state's only basis to challenge the CO_2 Emission Guidelines is the EPA's data on the four building blocks approach to emission reduction, then factors other than cost likewise cannot provide a basis for a variance. Factors such as system reliability, physical possibility of installing necessary control equipment, or other factors specific to the facility (or class of facilities) that make application of a less stringent standard or final compliance time more reasonable are excluded by EPA. Because EPA did not undertake unit-specific or state-specific analyses to determine whether meeting the carbon reduction standard will result in reliability or other problems, there is no data on these issues that a state can contest. The only issue for which the EPA provided state-specific data is whether a state can achieve the carbon reductions mandated in the proposed rule.

Even if a state can show flaws in the four building blocks data as applied to the state, it is not clear this would be sufficient to obtain a variance. Beyond EPA's denial of "case-by-case" exceptions, Administrator McCarthy stressed at the NARUC conference that the EPA's four building blocks approach is just "one way" to meet the standards. It is unknown whether a state would need to show that other possible "ways" of meeting the standard also are unworkable to obtain a variance. For example, if a state shows that the 70 percent gas combined cycle dispatch assumption (in Building Block 2) is not achievable because of, say, gas pipeline infrastructure, electric transmission constraints, or need for the gas capacity to load-follow intermittent resources, a state may still be able to achieve the carbon reduction mandate by shuttering a number of coal generation plants. It may be that states will have to prove impossibility of meeting the performance targets from any of the four pathways outlined in EPA's proposed rule[5] before EPA would consider flexibility.

We conclude that, while EPA's CO_2 Emission Guidelines may provide "flexibility" on the issue of how a state goes about meeting its carbon reduction mandate, the Guidelines do not allow for a less

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[3] Remarks of EPA Administrator Gina McCarthy at NARUC Summer Conference in Dallas Texas, July 14, 2014. We believe our contemporaneous notes faithfully represent these remarks and Chairman Kenney's question of Administrator McCarthy.

[4] EPA calculated the CO_2 performance goal using four "building blocks": (1) assuming a six percent heat-rate efficiency improvement to each existing coal-fired EGU; (2) assuming a 70 percent capacity utilization rate for combined-cycle gas-fired EGUs; (3) calculating a renewable portfolio standard (RPS) based on the average RPS of states in the same region of the country, and assuming usage of nuclear power plants based on existing and expected nuclear units; and (4) assuming a one and one-half percent per year reduction in electric usage through demand-side management (DSM) measures.

[5] In its State Plan Considerations Technical Support Document, EPA proposes four "state plan pathways": (1) rate-based CO_2 emission limits; (2) mass-based CO_2 emission limits; (3) a state-driven portfolio approach; and (4) a utility-driven portfolio approach. The EPA's four building blocks suggestion is one portfolio approach, which includes "emission limits for affected EGUs along with other enforceable end-use energy efficiency and renewable energy measures that avoid EGU CO_2 emissions."

stringent carbon reduction standard or compliance schedule based on a state showing of expected increase in electric rates, system reliability issues, physical impossibility of installing controls, or other factors based on a state's unique circumstances.

The state institutional dilemma arises because EPA's proposed rule contravenes the legislatively expressed expectations of 18 states for state primacy and EPA flexibility, as well as the Section 111(d) implementing regulations.

Accordingly, states with resolutions or legislation inconsistent with the EPA mandates will be placed in a very difficult position. State environmental agencies must follow state statute, and arguably should follow the language of legislatively-passed resolutions. To the extent they do so and their actions are inconsistent with the CO_2 Emission Guidelines, EPA will either choose to revise its proposed rule to respect the rights asserted by the states, or reject these state assertions. If EPA takes the latter course, then it may be impossible for states to comply with both the EPA CO_2 Emission Guidelines and the directives of their legislatures.

III. Legislation and Resolutions of 18 States

The following state legislatures passed either legislation or a resolution consistent with their reasonable expectation that the EPA CO_2 Emission Guidelines will preserve state rights and flexibility under Section 111(d) of the CAA:

Legislation

1. Kansas – House Bill 2636
2. Kentucky – House Bill 338
3. Louisiana – Act 726
4. Missouri – House Bill 1631
5. West Virginia – House Bill 6346[6]

Resolutions[7]

6. Alabama – Joint Resolution 57
7. Arkansas - Senate Resolution 2*
8. Arizona – Concurrent Resolution 1022
9. Florida – SM 1174
10. Georgia – House Resolution 1158
11. Illinois - House Resolution 0782*
12. Indiana - House Resolution 11*
13. Nebraska - Legislative Resolution 482
14. Oklahoma - Concurrent Resolution 39
15. Pennsylvania - House Resolution 815*
16. South Dakota - Concurrent Resolution 1022
17. Tennessee - House Joint Resolution 663*
18. Wyoming – Senate Joint Resolution 1

* Not Concurrent with other chamber

Consistent themes emerge from these legislative pronouncements. The overwhelming majority of these 18 states demand that the EPA respect state primacy in setting CO_2 performance standards, look at the individual circumstances of each state, and allow more lenient carbon reduction performance based on cost and other considerations. Many states also limit the carbon reduction goal to measures achievable "inside the fence" (*i.e.*, at the EGU source), disallow fuel switching at the EGU to meet the goal, require that any assumed technology to meet the goal be commercially demonstrated, and apply separate standards for coal and gas generation units. As explained below, it appears that virtually all of these expectations have been rejected in EPA's proposed CO_2 Emission Guidelines.

A. State Primacy

The states that passed resolutions and legislation concerning Section 111(d) assert primacy in

[6] Notably, the Ohio State House unanimously passed House Bill 506, although it was not passed by the Ohio State Senate. Ohio State House Bill 506 is similar to the legislation passed in Kansas, Kentucky, and West Virginia.

[7] To be sure, a Resolution is hortatory, not mandatory, like a law. Nevertheless, a state agency has some obligation to follow the policy direction set by the legislature.

determining what legally-enforceable carbon performance standards apply in each respective state. This is consistent with the plain language of the federal Section 111(d) implementing regulations. For example, Alabama Joint Resolution 57 states that the EPA "must maintain Alabama's and other states' authority as provided by the Clean Air Act, to rely on state regulators to develop performance standards for carbon dioxide emissions that take into account the unique policies, energy needs, resource mix, and economic priorities of Alabama and other states." Florida also urged EPA to "respect the primacy of Florida and rely on state regulators to develop performance standards for carbon dioxide emissions" that take into account Florida's unique policies, needs and priorities. Resolutions passed in Illinois, Indiana, Nebraska, Oklahoma, Pennsylvania, South Dakota, Tennessee, West Virginia, and Wyoming contain nearly identical language.

Similarly, Georgia and Kentucky found that "Congress charges the states, not EPA, with establishing standards of performance under [Section 111(d)] of the federal Clean Air Act." The State of Arkansas "urges EPA to withdraw the proposed guidelines for reducing carbon dioxide emissions from fossil fuel-fired power plants under [Section] 111(d) of the Clean Air Act and propose new guidelines that respect the primacy of the State of Arkansas to determine the emission reduction requirements that are in the best interest of its citizens." The remainder of the 18 states either explicitly or implicitly presume that their state agencies, not the EPA, will set the applicable carbon reduction standard.

> As described above, EPA's CO_2 Emission Guidelines reject the notion that states have any authority in setting the carbon emission standard. Instead, EPA has set the numeric carbon emission pounds per Megawatt hour limit for each state from 2020 through 2030. EPA's proposed rule further provides that the agency will evaluate and approve state plans based on four general criteria: 1) enforceable measures that reduce EGU CO_2 emissions; 2) <u>projected achievement of emission performance</u> <u>equivalent to the goals established by the EPA, on a timeline equivalent to that in the emission guidelines</u>; 3) quantifiable and verifiable emission reductions; and 4) a process for biennial reporting on plan implementation, progress toward achieving CO_2 goals, and implementation of corrective actions, if necessary.[8]

No latitude is provided for states to either set their own carbon reduction standard or deviate from the goals established by EPA.

B. <u>Inside the Fence</u>

The majority of states that passed a resolution or legislation regarding Section 111(d) would limit the carbon reduction standard to what is reasonably achievable inside the fence, *i.e.*, at the EGU source. For example, Alabama, Florida, Illinois, Indiana, Nebraska, Oklahoma, Pennsylvania, South Dakota, Tennessee, West Virginia, and Wyoming passed resolutions that convey that EPA should "approve state-established performance standards that are based on reductions of carbon dioxide emissions determined to be achievable by measures undertaken *at fossil-fueled electric generating units*," or language to the same effect.

Similarly, Louisiana and Missouri passed legislation directing their state environmental agencies to set the standard of performance based on reductions in emissions of carbon dioxide that can reasonably be achieved through measures undertaken *at each fossil fuel-fired electric generating unit*, including efficiency improvements. In each case the legislation allows utilities and EGUs to *implement* the standard through outside the fence measures, but the *setting* of the standard may only consider what is achievable inside the fence.

Three of EPA's four building blocks reside outside the fence. Perhaps recognizing that inside the fence measures are insufficient to meet EPA's 30 percent carbon reduction goal by 2030, only one building block assumption -- average heat rate improvement of six percent for coal-fired EGUs -- is source-focused. Building blocks 2, 3 and 4 of the CO_2 Emission Guidelines assume that utilities can meet certain outside the fence metrics. Although the proposed rule does not require states and utilities to actually implement these metrics, they are the root of each state's CO_2 performance goal.

The EPA's CO_2 Emission Guidelines do not allow for a state to deviate from its carbon reduction mandate by analyzing what is achievable at the source. EPA has assumed that greater carbon reductions may be achieved by looking outside the fence, so states must presumably employ these tools.

[8] CO_2 Emission Guidelines at 46 (emphasis supplied).

EPA has effectively rejected state resolutions and legislation that would afford the states flexibility to focus their carbon reduction efforts on what is reasonably achievable at the source. Whether EPA may lawfully force states to look at outside the fence measures or essentially require the closure or fuel switching of EGUs is in serious question given the focus on source-based emissions and state primacy in Section 111(d) of the CAA.

C. Variance Flexibility

Every state that passed resolutions or legislation requested that EPA grant "maximum flexibility" for states to set carbon reductions standards, implement the standards, or both.

The substantial majority of states passing legislation or resolutions express the right to an emissions reduction variance based on factors of cost, physical possibility, effect on local economy, and other factors unique to the state. These factors are based on the federal implementing guidelines, 40 C.F.R. § 60.24(f), which provides that states may make a case-by-case determination that a specific facility or class of facilities are subject to a less-stringent standard or longer compliance schedule due to: (1) cost of control; (2) a physical limitation of installing necessary control equipment; and (3) other factors making the less-stringent standard more reasonable.

However, EPA has rejected the possibility of granting a variance based on any of these factors. The CO_2 Emission Guidelines state at page 520 as follows:

> The EPA therefore proposes that the remaining useful life of affected EGUs, and the other facility-specific factors identified in the existing implementing regulations, should not be considered as a basis for adjusting a state emission performance goal or for relieving a state of its obligation to develop and submit an approvable plan that achieves that goal on time.

Whether EPA may lawfully dismiss this implementing regulation is beyond the scope of this paper.

The state-passed resolutions and legislation assert a right to a variance. For example, the resolutions passed by Florida, Illinois, Indiana, Nebraska, Pennsylvania, South Dakota, Tennessee, and Wyoming would allow the state "to set less stringent performance standards or longer compliance schedules for fossil-fueled electric generating units," or language to the same effect.

Kansas, Louisiana, and West Virginia passed statutes directing their state environmental departments to consider whether to adopt less stringent performance standards or longer compliance schedules for EGUs based on the following factors:

> (1) Consumer impacts including any disproportionate energy price increases on lower income populations;
> (2) Unreasonable costs of reducing emissions of carbon dioxide resulting from the age, location, or basic process design of the electric generating unit;
> (3) Physical difficulties with or the impossibility of implementing emission reduction measures for carbon dioxide;
> (4) The absolute cost of applying the performance standard to the electric generating unit;
> (5) The expected remaining useful life of the electric generating unit;
> (6) The economic impacts of closing the electric generating unit, including expected job losses, if the unit is unable to comply with the performance standard; and
> (7) Any other factors specific to the electric generating unit that make application of a less stringent performance standard or longer compliance schedule more reasonable.[9]

Apart from granting variances, several states list cost and reliability as factors that should be considered in the initial setting of the carbon emissions reduction standard. These states include the ones listed above, as well as Georgia, Kansas, and Kentucky.

[9] West Virginia's statute adds the additional factors of: (1) Non-air quality health and environmental impacts; (2) Projected energy requirements; (3) Market-based considerations in achieving performance standards; and (4) Impacts on the reliability of the system. Missouri's statutory factors include the ones listed in the federal implementing guidelines, as well as (1) the absolute cost of applying the emission standard and compliance schedule to the existing affected source; (2) the outstanding debt associated with the existing affected source; (3) the economic impacts of closing the existing affected source, including expected job losses if the existing affected source is unable to comply with the performance standard; and (4) the customer impacts of applying the emission standard and compliance schedule to the existing affected source, including any disproportionate electric rate impacts on low income populations.

State laws direct their environmental agencies to consider less-stringent carbon reduction standards and compliance schedules based on such factors as cost; effect on electric rates, jobs, low-income populations, and the economy; effect on reliability of the system; engineering considerations; and other factors unique to the state. The EPA appears to have foreclosed the possibility of considering these factors in its proposed rule.

D. Other Factors

States have asserted several other rights associated with Section 111(d) of the CAA, including disallowing fuel switching (*e.g.*, from coal to gas), co-firing with other fuels, or decreased unit utilization as bases to meet carbon reduction standards (Kansas, Kentucky, Louisiana, West Virginia); precluding the assumption of technology that is not adequately demonstrated as a basis for carbon reduction (Georgia, Kansas, Kentucky, Louisiana, West Virginia); and the right to set carbon reduction standards separately for coal and gas-fired EGUs (Kansas, Kentucky, West Virginia).

In sum, the states' views and the EPA's proposed rule essentially talk past one another. The states assert rights and direct their agencies how to approach analysis under 111(d), and the EPA proposal expects a State Implementation Plan (SIP) that goes beyond those boundaries expressed in state law.

This gives rise to the question of what rights a state has if the four building block assumptions prove to be inaccurate or impractical for the state. If a state cannot reasonably achieve the mandated carbon reduction through increased renewable energy, demand side load reduction, increased utilization of gas-fired combined cycle units, and heat rate improvements to coal EGUs, it may need to look at the very measures precluded by legislation, such as fuel switching, decreased utilization of certain EGUs, and attempting to use technology that has not been adequately demonstrated. EPA's rejection of legislatively-passed declarations and statutes places states agencies tasked with implementing the rules in a very difficult position.

IV. State Agencies Bound to Follow State Law

Given the state resolutions and legislation discussed above, state agencies may find themselves in the unenviable position of not being able to follow both the EPA mandate and state legislative pronouncements. In such a case, state agencies are bound to follow applicable state legislation.[10]

Put another way, a state agency cannot conduct a preemption analysis and declare that a state law directing how the agency should perform its Section 111(d) determination must give way to a rule promulgated by EPA. State environmental agencies may not, for example, ignore statutory commands to set carbon reduction standards based on what is reasonably achievable in light of cost, reliability, and engineering considerations.

The state statutes that have been rejected by EPA control the state agencies that will conduct Section 111(d) proceedings. The eight resolutions passed by state legislatures (and five by one chamber of state legislatures) indicate that many states may pass new legislation in 2015 or 2016 that likewise collide with EPA's proposed rule. Two conclusions follow: (1) courts will likely decide which regulations are more consistent with the CAA, the state statute or EPA's proposed rule; and (2) EPA will either back down and respect state pronouncements, or subject these states to a federal implementation plan, or FIP. The latter choice also calls for court resolution.

V. Initial Conclusions and Takeaways

We offer these tentative conclusions and takeaways based upon the above analysis and discussion:

- 18 state legislatures passed either legislation or resolutions that EPA has rejected in its CO_2 Emission Guidelines.
- EPA's CO_2 Emission Guidelines sets firm carbon reduction standards that must be met by each state beginning in 2020 and accelerating through 2030, and denies "case by case" exceptions based on factors discussed in federal implementing regulations.

[10] Some may argue that the state statutes discussed in this Paper create an impermissible obstacle that frustrates the federal purpose of the CAA and EPA's CO_2 Emission Guidelines. We see no such conflict. The state laws direct the appropriate state regulator to conduct specific analyses in formulating legally enforceable emission standards – a right explicitly reserved to the states under Section 111(d) and its federal implementing regulations. These state laws do not attempt to frustrate the federal purpose of the proposed CO2 Emission Guidelines or put in place an impermissible obstacle to its implementation. Rather, they exert state primacy and the rights left to the states under Section 111(d).

- The EPA CO_2 Emission Guidelines do not allow states to set their own carbon performance standards, notwithstanding the fact that states believe they have primacy pursuant to Section 111(d) in determining what standards should apply based on unique state circumstances.

- According to EPA Administrator McCarthy, unless a state can show that EPA's data related to its four building block approach is flawed, EPA will not entertain a less stringent carbon reduction target. However, the state-specific data provided in EPA's proposed rule relates to meeting the carbon reduction standard, not cost or reliability. This does not afford states the opportunity to request EPA consideration of a less stringent standard based on cost or reliability factors.

- The majority of states enacting resolutions or legislation regarding Section 111(d) would limit the carbon reduction standard to what is reasonably achievable inside the fence, *i.e.*, at the EGU source. However, EPA's CO_2 Emission Guidelines do not allow for a state to deviate from its carbon reduction mandate by analyzing what is achievable at the source.

- States have directed their environmental agencies to consider less stringent carbon reduction standards and compliance schedules based on cost; effect on electric rates, jobs, low-income populations, and the economy; effect on reliability of the system; engineering considerations; and other factors unique to the state. It does not appear that EPA will entertain variance requests that are based on any of these factors.

- States with resolutions/legislation inconsistent with the CO_2 Emission Guidelines will not be able to comply with both legislatively-expressed declarations and EPA's mandate. EPA will either choose to revise its proposed rule to respect the rights asserted by the states, or reject these state assertions and invite litigation. States are then left in the impossible dilemma of ignoring state law to follow EPA's prescribed mandate, which would, by definition, be an illegal act by a state agency.

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EPA'S CARBON PLAN: FAILURE BY DESIGN

Wednesday, July 30, 2014

House of Representatives,

Committee on Science, Space, and Technology

Washington, D.C.

The Committee met, pursuant to call, at 10:07 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Cynthia Lummis [Chairwoman of the Committee] presiding.

Chairwoman LUMMIS. Good morning. The Committee on Science, Space, and Technology will come to order.

Welcome to today's hearing entitled ''EPA's Carbon Plan: Failure by Design.'' In front of you are packets containing the written testimony, biography, and truth-in-testimony disclosures for today's witnesses.

And without further ado, I now recognize myself for 5 minutes for an opening statement.

Today, we are examining one of the most sweeping regulatory proposals in American history. The EPA is attempting to take control of our nation's electric system without legal or scientific justification. The EPA's Clean Power Plan reaches well beyond the regulation of power plants. The EPA wants to control the entire system, right down to the amount of electricity Americans use in their homes.

The implications of this overreach really are staggering. The rule has the potential to shut down power plants across the Nation, raise energy prices, and threaten energy security. And I submit for what? The EPA admits that the rule will have little or no impact on global warming. In this case it appears to be regulation in the name of climate change but it is just regulation in the name of regulation, federal control for federal control's sake.

EPA's proposal would impose standards on States that

turn power systems on their heads. Each State's reduction mandate varies widely, based on what the EPA claims can be done through a combination of costly efficiency technologies, drastic fuel switching, and unprecedented reliance on intermittent renewables and energy rationing.

States, companies, and utility commissioners and local officials are left figuring out how to comply, which will necessarily involve higher prices and potentially threaten grid reliability. The EPA claims the rule is flexible and that compliance is easy. But the EPA's assurances are of little comfort when the standards are beyond what technology can deliver and ratepayers can afford.

The ability of the EPA's so-called building blocks, which are really mandates, to produce the required reductions is uncertain. The limited analysis in this rule is based on black box models and untested assumptions. This hides the hard fact that ratepayers will be left holding the bag on an expensive overhaul of our electric system to reach theoretical and unproven targets.

The confusion also hides a more fundamental concern. The EPA is operating outside the bounds of the law. The Clean Air Act does not give the EPA the authority to regulate the electric grid or tell Americans where to set their thermostat. Instead, EPA is limited to technology-based standards at the power plants themselves.

As our witnesses will explain, had EPA followed the law and been straightforward about what technology can accomplish, the rule might be manageable. But since the law doesn't match this Administration's agenda, the EPA is now bypassing Congress to rewrite the statute. The EPA also ignores technology and reliability concerns. The Administration hasn't fully considered the potential impacts of this proposal on the electric system, the economy, and the American people most importantly.

A scientific look at the proposal reveals major problems. EPA's claims are backed by flawed technology assumptions. It relies on unrealistic scenarios about our nation's energy future. And EPA's conclusions are based on a secret model, hidden from public view. We see this all too often at EPA. In fact, serving on Natural Resources Committee and other natural resource matters, we see it all the time at this--in this natural resource environment that we are in with this Administration.

This science that is hidden science undermines the scientific review process and moves straight to regulation. The law requires a bottom-up review of what can be accomplished at a power plant. Instead, the EPA has proposed top-down regulation of the entire electric system. This rule needs to be withdrawn. It fails to meet even the most basic standards of objectivity and transparency; it lacks technical

analysis on scientific and economic feasibility, and the American people deserve to know exactly what the EPA is doing, and that is why we are having this hearing today. Other than that, my constituents have no strong feelings about this.

[The statement of Mrs. Lummis follows:]

********** INSERT 1 **********

Chairwoman LUMMIS. That is my opening statement and now I would like to recognize the Ranking Member, the gentlewoman from Texas, Mrs. Johnson, for an opening statement.

Ms. JOHNSON. Thank you very much, Madam Acting Chair. And let me thank our witnesses for being here this morning.

Last month, the Environmental Protection Agency released its Clean Power Plan, a proposal to cut carbon pollution from the largest source, power plants. This proposal, like the rest of President Obama's Climate Action Plan, is the bold step forward. Our nation needs to address the impacts of climate change, impacts that are growing more present in the lives of every American.

Severe drought, record temperatures, and an increase in the spread of infectious diseases are just a few examples of what America will have to confront in the coming years. The scientific evidence confirms that we need to act now to lessen these impacts. Cutting carbon emissions from the power sector is critical to any solution that is--and that is why I support the Clean Power Plan. It sets reasonable limits that take into account the characteristics of each State. It is based on strategies already in use such as improving energy efficiency and power plant operations and encouraging the development of renewables. And finally, it provides the States with flexibility.

EPA is not prescribing a specific set of measures.

States will choose what goes into their plans and they can work alone or as part of a multistate effort to achieve meaningful reductions. Today, we will hear from some members and witnesses that EPA is acting beyond its authority and that EPA regulations are killing the economy and jobs.

This is not a new argument but one that we have heard time and time again. Whenever EPA proposes an action that will protect the air we breathe and the water we drink, industry raises alarms about the purported negative impact on the economy. I expect we will hear the same argument trotted out once again in today's hearing.

In addition, some of my colleagues on the other side of the aisle are fond of saying that those who want to address climate change are alarmists using scare tactics to frighten the American people. I would say that the true alarmists are those who have a history of exaggerating the cost of compliance. For example, in 1990, electric utilities opposed to the Acid Rain Program said that the cost of an allowance to admit sulfur dioxide would be $1,500 per ton. It in fact turned out to be $150 per ton.

Madam Chair, I could go on but the track record of Clean Air Act speaks for itself. Since its adoption in 1970, air pollution has declined more than 70 percent and the American economy has more than tripled. Now more than ever the American people need a strong EPA. I firmly believe that we

can have a vibrant economy and a safe and healthy environment. The Clean Power Plan puts us on the path to achieving both.

Thank you. And before I yield back, I would like to request that Mr. Kennedy be allowed to introduce Dr. Cash.

Thank you. I yield back.

[The statement of Ms. Johnson follows:]

********** INSERT 2 **********

Chairwoman LUMMIS. Mr. Kennedy, we will--when we reach Dr. Cash's introduction, I will yield to you at that time. Thank you.

Mr. KENNEDY. Thank you, Madam Chair. Thank you, Ranking Member.

Chairwoman LUMMIS. If there are members who wish to submit additional opening statements, your statements will be added to the record at this point.

[The information follows:]

********** COMMITTEE INSERT **********

Chairwoman LUMMIS. At this time I would like to introduce our witnesses. Our first witness today is Mr. Jeff Holmstead. Mr. Holmstead is one of the Nation's leading air quality lawyers and heads the Environmental Strategies Group at Bracewell and--how do you pronounce it--Giuliani. Okay. He previously served as Assistant Administrator at the EPA for the Office of Air and Radiation. He also served on the White House staff as Associate Counsel to former President George H.W. Bush. Mr. Holmstead received his law degree from Yale.

Our second witness is Charles McConnell, Executive Director at the Energy & Environment Initiative at Rice University. Previously, Mr. McConnell served as the Assistant Secretary for Fossil Energy at the U.S. Department of Energy. At DOE he was responsible for the strategic policy leadership budgets, project management, and research and development of the Department's Coal, Oil, Gas Advanced Technology Programs and the National Energy Technology Labs. He received his bachelor's degree in chemical engineering from Carnegie Mellon and an MBA from Cleveland State.

And now to introduce Dr. David Cash, I will yield to the gentleman from Massachusetts, Mr. Kennedy.

Mr. KENNEDY. Thank you, Madam Chairman.

We are here today in part to examine how States can be empowered to use an innovative approach to successfully

navigate the challenges they confront. To that end, I am delighted to welcome Dr. Cash, a constituent and a Commissioner of the Massachusetts Department of Environmental Protection.

Throughout his career in public service, Dr. Cash has played an integral role in our Commonwealth's efforts to address climate change, first, as the Under Secretary for Policy in the Massachusetts Executive Office of Energy and Environmental Affairs, then as Commissioner at the Massachusetts Department of Public Utilities. He has been a leader in developing a Massachusetts Clean Energy and Climate Plan for 2020 and other legislation that will reduce the State's greenhouse gas emissions, legislation that has contributed to a 16 percent statewide drop in emissions since 1990. Beyond the success we have experienced in limiting emissions, these initiatives have also led to an 11.8 percent increase in clean tech job growth in the last year.

Dr. Cash, as Congresswoman Clark and I often cite the success of Massachusetts to others in this room, we are very happy to have you here today and look forward--I am looking forward to your testimony.

Thank you, Madam Chairman. I yield back.

Chairwoman LUMMIS. I thank the gentleman from Massachusetts.

Our final witness today is Mr. Gregory Sopkin, Partner

at Wilkinson Barkett and Knauer--what is it? Barker?

Mr. SOPKIN. Barker.

Chairwoman LUMMIS. Okay.

Mr. SOPKIN. Thank you.

Chairwoman LUMMIS. Got a typo here. Previously, Mr. Sopkin was the Chairman of the Colorado Public Utilities Commission, a neighbor here. Thanks. I am from Wyoming.

He has also worked as Assisting Attorney General for Colorado. He has practiced energy and telecommunications law for over 15 years and has been a member of the National Association of Regulatory Utility Commissioners. Mr. Sopkin received his law degree from the University of Colorado.

As our witnesses should know, spoken testimony is limited to 5 minutes after which the members of the committee will have 5 minutes each to ask questions.

I now recognize our first witness, Mr. Holmstead, for 5 minutes. Welcome.

STATEMENTS OF JEFFREY HOLMSTEAD, PARTNER, BRACEWELL & GIULIANI, LLP; CHARLES MCCONNELL, EXECUTIVE DIRECTOR, ENERGY & ENVIRONMENT INITIATIVE, RICE UNIVERSITY; DAVID CASH, COMMISSIONER, MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL QUALITY; AND GREGORY SOPKIN, PARTNER, WILKINSON, BARKER, KNAUER, LLP

STATEMENT OF JEFFREY HOLMSTEAD

Mr. HOLMSTEAD. Thank you and good morning. I thank you very much for giving me the chance to testify this morning.

There is a lot to say about EPA's proposal, but this morning, I would like to focus on just two major points. First, anyone who believes in the rule of law should be troubled by EPA's proposal. It goes far beyond the authority that Congress has given to the agency.

And second, EPA officials have and so distracted with the notion that they can fundamentally change the electric system in 49 States that they have failed to do the basic technical work that they are supposed to do to develop legally defensible regulations to reduce carbon emissions from existing power plants.

The Supreme Court has made it clear that EPA has

authority to regulate carbon emissions under the Clean Air Act but the Supreme Court has not given EPA a roving mandate to do whatever it thinks best when it comes to regulating those emissions. In the Clean Air Act Congress created literally dozens of different regulatory programs with carefully defined limits. Some of these programs can be used to regulate carbon emissions, but EPA may only do so in a way that complies with the limits established by Congress.

EPA has proposed to use Section 111(d) to regulate carbon emissions from existing power plants. There is a significant question about whether they can even use that provision, but I want to set that aside and ask the question if EPA can regulate carbon emissions from existing power plants under Section 111(d), what would those regulations look like?

And it has been interesting to me. There is all this debate about this proposal and few people ever actually look at what the statute says. So let me quote from the relevant provisions of the statute. It says that ''EPA can require a State to develop a plan that includes a standard of performance that requires a continuous emission reduction for any existing power plant in their State based on the best system of emission reduction that has been adequately demonstrated for that type of plant but that States shall be permitted in applying the standard of performance to any

particular source to take into consideration, among other factors, the remaining useful life of the existing plant to which such standard applies.'' That is just what the statute says, and what EPA has done for 37 years under that regulation is to establish an allowable emission rate that each plant would have to meet.

But somehow, EPA has discovered a broad new power from these words, a broad new power in a provision that has been in place for almost 40 years. After all this time, it turns out that this provision actually gives EPA the authority to require States to fundamentally change the way that electricity is generated and used throughout their States.

Here is what EPA expects States to do: first, require all existing coal-fired power plants to improve their efficiency by an average of 6 percent regardless of how efficient they are today or whether it is technically feasible to improve their efficiency by that much. But at least that is close to the statute.

Second, they want to be States to take business away from these more efficient coal plants and give this business to the gas-fired power plants in the State until the gas-fired plants are operating at 70 percent capacity regardless of the cost or whether these gas-fired plants were even designed to operate that much.

Third, EPA believes that it can require States to

mandate more wind and solar power plants be constructed and used.

And fourth, to come up with programs to require people and industries to use less electricity so that the total statewide demand for electricity is reduced by 1.5 percent a year every year for 10 years.

All these things, according to EPA, can be required under a statutory provision that says the following: ''EPA can require States to set a standard of performance for any existing power plant in their States but that a State must be permitted in applying a standard of performance to any particular plant to consider the remaining useful life of that plant.''

Simply put, EPA's reading is preposterous. And because the folks at EPA have been so distracted by the notion that they can change the electric power system in our country, they have failed to do the basic technical work they are supposed to do under the Clean Air Act. What they are supposed to do is actually go out and study existing power plants to determine the lowest carbon emission rates that have been achieved by different types of plants based on size, boiler type, age, and other factors and then provide technical guidance to the States so that the state environmental officials have the information they need to go out and set appropriate emission standards for the plants in

their States. The sooner EPA does what it is actually supposed to do, the sooner we will have a defensible program to reduce carbon emissions from existing power plants.

Thank you and I would be happy to answer any questions you may have.

[The statement of Mr. Holmstead follows:]

********** INSERT 3 **********

Chairwoman LUMMIS. I thank the gentleman.

I now recognize our second witness, Mr. McConnell, for 5 minutes.

STATEMENT OF CHARLES MCCONNELL

Mr. MCCONNELL. Thank you. I am here to talk about EPA's carbon plan and Clean Power Plan, and unfortunately it is neither of the two.

So what is it and what is it not? Well, it is certainly not impactful environmental regulation. In fact, Administrator McCarthy testified in 2013 to that very effect in front of the House of Representatives and suggested that it was really being developed for political leverage in a global climate discussion.

So let's talk about how much of an impact it really is. It impacts, if fully developed, .18 percent of the global CO2 that is admitted in the world, less than 2/10 of a percent. It will impact global warming and climate change by .01 degrees centigrade. And that, if you do the mathematics and climate change, technology, would affect the level of sea rise by about 1/3 the thickness of this dime that I am holding. It is hard to see, I know, but it is 1/3 of that thickness.

It is also not flexible. Administrator McCarthy has mentioned that it is too flexible in fact in some States and that we haven't really prescribed it enough. Well, truly, if you look at the outputs of a coal-fired power plant or even a

natural gas-fired power plant, you will see that it is a disingenuous comment. In fact, there is no other way for this to be achieved than to simply mandate more windmills and more solar panels. It is just that simple.

And at the end of it all, where is the question on affordability and what have we heard from the EPA? And what you hear right now is the sound of silence. There is nothing that has been said. As a matter of fact, the questions have been dodged, unanswered, and not addressed at all. But if you look at the mathematics of the way it works and the way technology is deployed, on average across this country the average ratepayer will see its rates go up by about two times. But in the five States that are going to bear 40 percent of the burden of this CO2 reduction, those ratepayers are going to see anywhere from 3X to 4X. So if this gets put forth, you won't have to wonder why your power bill is more expensive; it is directly related to this.

And the other problem is the inconvenient truths are that we don't have any studies on reliability; we don't have any studies on affordability. There is really no evidence of any interagency collaboration, FERC and the natural gas availability for all the fuel switching that is being anticipated. Transmission capacity and capability, the Department of Energy and the Office of Electricity have that capability but there is no evidence that there is any

connection there. Operating plant efficiencies by the National Energy Technology Laboratory and Fossil Energy have copious amounts of information that have not been tapped into. And of course the carbon capture and storage and CCS technology development roadmap has fundamentally been avoided with this.

So really this is dangerous and damaging to the American consumer, to industry, and to our global competitiveness. And unfortunately, what we are doing is we are wrapping this up as an environmental victory and there isn't any environmental victory. It is a disingenuous ''all pain for no gain'' program and it is difficult to understand. I would suggest that what we need to do is pivot this conversation to a discussion around world-class technology so that we can have real environmental responsibility and a real all-of-the-above approach, not just CO2 but all the issues associated with environmental responsibility not only in our country but globally. We need to study the situation around energy reliability. It is too important and it needs to tap into the agencies that we had here in our system to be able to do that.

And finally, we have to drive toward affordability for all citizens, not just in our country but to think about the global implications of the developing nations around the world and their need for advanced technology. The rest of

the world doesn't need our political platitudes and morals. What they need is our technology that we are so capable to develop that we need to fund and deploy.

Thank you.

[The statement of Mr. McConnell follows:]

********** INSERT 4 **********

Chairwoman LUMMIS. I thank the witness and now recognize our third witness, Dr. Cash.

STATEMENT OF DAVID CASH

Mr. CASH. Thank you very much, Chair Lummis and Ranking Member Johnson and other members of the Science, Space, and Technology Committee for the opportunity to provide comments on EPA's proposed Clean Power Plan.

My name is David Cash. I am the Commissioner of the Massachusetts Department of Environmental Protection, and prior to this, I was Commissioner of our State's Public Utilities Commission and focused on grid reliability and cost for ratepayers. In total, I have worked in State Government for 10 years, always at the nexus of energy, environment, and economic development and always with the goal of creating a thriving State for families, communities, and businesses.

Let me start with a story of dramatic change. Eight years ago there were 3 megawatts of installed solar power Massachusetts. Today, there are over 500 megawatts. Eight years ago there were 3 megawatts of installed wind power. Today, there are over 100 megawatts. Today, there are over 5,000 companies and over 80,000 people employed in the clean energy economy in our State, and for the last 4 years, clean

energy job growth has been between 6 percent and 12 percent per year.

Today, Fortune 500 companies and mom-and-pop shops, residential customers in cities and towns are taking advantage of our energy efficiency and renewable energy programs and saving billions of dollars. For a company this may mean hiring new people or expanding R&D or marketing. For a town, maybe new teachers or firefighters can be hired. For families across the Commonwealth, they have more money in their pockets that they are not spending on energy. Over the last several years we have invested over $1 billion in energy efficiency and expect a return of $3-$4 billion.

The arc of this story is simple. Wise environmental protection and robust economic development can and should go hand-in-hand. In fact, since 1990, our carbon emissions in Massachusetts have declined by 40 percent while our economy has grown by almost 70 percent.

[Slide]

Mr. CASH. If you will take a look at the graph that is shown on the screens now, take a look particularly at the bottom line, the red line that shows our greenhouse gas emissions in the power sector declining by 40 percent, most of that in the last 8 to 10 years, but over the last 20 years by 40 percent. At the same time, look at the top line. That shows our economic growth of over 70 percent. You can see

some other indicators in the middle, but the story is a powerful story that shows that environmental protection can go hand-in-hand with economic development.

The Administration of Governor Deval Patrick has launched a clean energy revolution in our State introducing forward-looking policies and wide-ranging regulatory reform and regional partnerships. One of his first actions in office was to bring all of the energy and environment agencies under one umbrella and add a mandate to link environmental protection and economic development.

We have approached EPA's 111(d) rule with exactly this comprehensive perspective understanding how these regulations will impact the power sector, energy prices, the environment, and economic development.

Our conclusion is that implementation of 111(d) will mirror what has happened in the last 8 years in Massachusetts and other States but on a national scale. The private sector will respond, sparking innovation, entrepreneurship, energy cost savings, job growth, customer choice, and opening up global markets for U.S. products and services.

In preparing the Clean Power Plan, EPA conducted an unprecedented amount of outreach to States and other key stakeholders recognizing the need for flexibility in the diversity of state-led initiatives and programs. One such successful program is the multistate Regional Greenhouse Gas

Initiative, RGGI. RGGI is a regional market-based emissions reduction program for the power sector, in other words, setting a standard and letting the market work. In the Clean Power Plan EPA recognizes regional market-based programs as acceptable compliance mechanisms. This is critical because the evidence is clear. RGGI and the RGGI experience has demonstrated that we can cost effectively realize environmental and economic goals while maintaining electricity grid reliability.

The RGGI States have experienced a 40 percent reduction in power sector emissions since 2005 while our regional economy has grown by 7 percent, adjusted for inflation. Of course, these significant pollution reductions are due to a combination of factors including market forces, the greater supply of natural gas, and other state clean energy policies, but RGGI has clearly been a driver as well.

A recent independent analysis by the Analysis Group concluded that investments for the first RGGI control period in energy efficiency, renewable energy, and other programs are adding $1.6 billion of net economic value to our region. In the RGGI region, these emissions reductions and types of strategic investments by Massachusetts and other RGGI States occurred while customer rates were dropping. Our original prediction, as we began developing RGGI, where that electricity rates would increase by 1 to 2 percent. Instead,

region-wide they have declined by 8 percent.

I know that we are not Kentucky or West Virginia or other States that are facing difficult challenges, but I also know that the low-hanging fruit of energy efficiency is available everywhere and grabbing that low-hanging fruit means savings for customers, local jobs, and greenhouse gas emission reductions.

EPA should be commended for developing the proposed rule that recognizes the diversity among States and provides a flexible approach to compliance. By providing the States with this flexibility, Massachusetts believes the plan will not only aid in the effort to reduce carbon pollution but will also help our nation develop an advanced infrastructure that delivers cleaner air, smarter energy use, and an improved economy and local jobs.

Thank you and I am happy to answer questions.

[The statement of Mr. Cash follows:]

********** INSERT 5 **********

Chairwoman LUMMIS. I thank the gentleman and now recognize our final witness, Mr. Sopkin, for--is it Sopkin?

Mr. SOPKIN. It is Sopkin.

Chairwoman LUMMIS. Okay. For 5 minutes.

STATEMENT OF GREGORY SOPKIN

Mr. SOPKIN. Thank you. And it is an honor to be here from the great State of Colorado where we don't always win Super Bowls but we have a really balanced energy portfolio.

From 2003 to early 2007 I was the Chairman of the Colorado Public Utilities Commission. I am approaching this testimony primarily from a State perspective, what States are looking at and having to implement this EPA rule.

We have written a white paper. My partner Ray Gifford, who also was a Chairman of the Colorado PUC, and I wrote a white paper about the logistical political and practical difficulties States are going to have in implementing this EPA rule.

I also have to give a shout out to our associate Matt Larson who had a big hand in offering this and had a baby boy yesterday. And we as a compassionate firm gave him the day off yesterday.

We wrote this paper because of our experience as State

Commissioners in working with state environmental departments and state legislatures. Some of the white paper's findings are, first, the EPA's proposed carbon reduction rule creates a carbon-driven energy resource planning process that is unlike any other Clean Air Act regulatory regime. The proposed building blocks look strikingly like integrated resource planning, which is a function that has traditionally been performed by States that have the expertise and manpower to delve into those matters deeply. Carbon IRPs or their equivalent will almost certainly require state legislation regardless of whether a State is vertically integrated or deregulated States.

The time constraints for States in implementing this rule are potentially insurmountable. States have little time, particularly given the need to pass legislation, to make crucial and far-reaching decisions regarding this proposed rule. The decision points include whether to act individually or on a multistate basis and determining what state agencies should take the lead in implementing and overseeing this process.

The scope of the EPA rule creates implementation--excuse me--creates a serious risk of EPA takeover of state resource planning. If a State implementation plan is a deemed inadequate by EPA, then it is up to the EPA to then devise the plan for States to follow.

Next, a carbon adder for environmental dispatch is likely a necessary implementation feature regardless of market structure. That means that there has to be something similar to a carbon tax that is imputed upon the regulatory structure.

Next, all generators must participate in the carbon IRP process from investor-owned utilities to non-jurisdictional entities not traditionally subject to regulation. That includes rural cooperatives and municipal utilities who have never had to submit a resource plan before are now going to be subject to regulation of some state agency over their resource planning.

Central resource planning will return to restructured, competitive States. In restructured States, States have opted to use competition as the method for lowest-costing electricity and to determine their optimal resource mix. That will now give way to carbon planning.

Multistate SIPs are accompanied by legal and practical hurdles, including the potential need for a congressionally approved interstate compact. The EPA approval criteria requiring adequate enforcement mechanisms implicate the United States Constitution Compact Clause because enforcement can and should be on an interstate basis to address inevitable rivalries that will develop in an interstate agreement between States.

In my view of the EPA's Section 111(d) proposal fundamentally transforms state commission sovereignty over resource planning in determining what is best for electric consumers. I have seen firsthand the effects of electric reliability problems and high cost generation in my home State, Colorado. The EPA has repeatedly invoked the refrain ''flexibility,'' meaning we don't care how your State reaches that prescribed carbon reduction level, but you must get there and you have 1 year to submit a plan to do it. This is analogous to saying you have 6 gallons of gas to get from San Francisco to New York City in 24 hours but you have the flexibility regarding your mode of transportation. One could be forgiven for not thinking that that is flexibility. The problem here is that EPA has declined to offer flexibility on the all-important issues of cost, capacity, and feasibility. In fact, EPA has implicitly declined to offer the State flexibility inherent in its very own Section 111(d) implementing regulations.

The remainder of my written testimony is the contents of the white paper. I look forward to your questions.

[The statement of Mr. Sopkin follows:]

********** INSERT 6 **********

Chairwoman LUMMIS. And I thank all the witnesses for their testimony and for being here today.

We will now begin member questions. The Chair will at this point recognize herself for 5 minutes.

First of all, Mr. Sopkin, you mentioned in your testimony rural cooperatives, which are a big component of providers of electrical power in my very rural State of Wyoming, as well as in Colorado, your home State. Are there unique difficulties for States with rural electric co-ops in being able to hit a 70 percent gas utilization rate?

Mr. SOPKIN. Thank you, Chairman. And if I could have Slide 2 shown, I think that would give you an idea of what rural cooperatives are up against.

[Slide.]

Mr. SOPKIN. This is a--this slide was released by the Colorado Air Quality Control Commission and it--what it does is it shows where the EPA's 2030 goal is, which is a limit of 1,108 pounds per megawatt hour and it superimposes that on top of every electric generating unit resource in Colorado. This shows you that every coal unit is in violation of the EPA rule on a pure rate emissions basis. The ones that are under the red line are all gas units. One gas unit actually exceeds this limit. And what you can see from this is that many of these coal plants are operated by rurals and municipals and so they are going to be affected pretty

dramatically by this rule.

As far as the 70 percent dispatch, there are many questions about that. In particular, the national utilization average for combined cycle units, gas units, is 48 percent. The EPA standard pushes that up to 70 percent. In most States the utilization rate is somewhere around 30 or 40 percent. Now, why is that? It is because running that gas combined cycle unit is more expensive than the baseload unit that they traditionally run on an 80 or 90 percent basis. It also could be because they don't have the adequate gas line--gas pipeline infrastructure to do it or the electricity transmission rights to do it. So EPA just simply did the cookie-cutter approach of every State, go to 70 percent, without knowing whether a State can actually achieve that because you have to delve deep into whether those transmission rights, those--the pipeline infrastructure is there. But also it is probably going to result in significant rate increases because it is more expensive to run a gas unit than a baseload unit.

Chairwoman LUMMIS. Thank you. I would also like to ask Mr. McConnell a question about the EPA targets. How reasonable are they? Let's look at coal generators. Can they improve their heat rate by 6 percent? As the gentleman from Colorado stated, overall utilization to 70 percent for natural gas combined cycle; States meeting renewable energy

deployment targets of 13 percent nationwide; end-user energy efficiency improvements, are these targets realistic?

Mr. MCCONNELL. You know, I am all for regulations and environmental responsibility. I am having a hard time figuring out why we are talking about deployment and execution of something that fundamentally doesn't impact the environment. The targets that have been set are all about finding a mechanism to eliminate coal and ultimately natural gas from our energy mix and require renewables to be deployed.

Now, it is dressed up to look like there is some sort of technical evaluation behind it, but in fact the targets that you just cited are not only difficult to achieve but require advanced technology, advanced development of that technology, and are not something that people will be able to make that decision to go to in the time frame that has been proposed. And so, again, we are in a situation where we are talking about deployment and yet we are getting no value for it.

Chairwoman LUMMIS. I thank the gentleman. My time is expired.

And I do want to allow Mrs. Johnson, the member from Texas and Ranking Member, to ask questions for 5 minutes.

Ms. JOHNSON. Thank you very much.

Recently, three important leaders from different backgrounds and political ideologies--Michael Bloomberg,

Henry Paulson, and Tom Steyer--came together to study the impacts of climate change would have on American businesses. This effort culminated in the report called ''Risky Business: The Economic Risk of Climate Change in the United States.'' And, Madam Chairman, I would like to submit this by unanimous consent for the record.

Chairwoman LUMMIS. Without objection.

[The information follows:]

********** INSERT 7 **********

Ms. JOHNSON. The report didn't parse words stating unequivocally ''every year that goes by without a comprehensive public and private sector response to climate change is a year that looks--locks in future climate events that will have a far more devastating effect on our local, regional, and national economies.''

Dr. Cash, as I understand it, many businesses already include climate risk as part of their business model. Can you comment on the engagement and interest in businesses in Massachusetts and the Northeast in achieving carbon reductions?

And the second question, what are the potential impacts to the economy of Massachusetts and its businesses if we do not address climate change now?

Mr. CASH. Thank you very much, Ranking Member Johnson. I will actually take those in reverse order because they--one builds on the other.

We think there--and the science shows and the evidence shows that there is already impacts on climate change and all you need to do is to be in any part of the country where we see high-impact weather events happening that are happening much more frequently than had previously been happening. In the Northeast we struggled with Super Storm Sandy, Irene, a freak October snowstorm. All of those happened while I was a PUC Commissioner and the outages that lasted days and days

and days was certainly something that we struggled with. And there is no question that a coastal State like Massachusetts is dealing with sea level rise already.

Businesses are already concerned and are already making plans to deal with climate change. There is no question that in the insurance industry they are addressing climate change. There is no question in the development community they are looking at extra expenses in development along coastal areas. And in the public sector we are very concerned about infrastructure. That is one of the primary reasons that action on climate change is so fundamentally important because we want to avoid those kinds of large problems that we are going to see on a greater scale in the future. And we see huge economic opportunities to address this problem in terms of clean energy development.

Ms. JOHNSON. Thank you.

Now, in your testimony you indicate that significant pollution reductions achieved in the Northeast were due to a combination of factors, but the Regional Greenhouse Gas Initiative has been a driver. You also conclude that implementation of the Clean Power Plan will mirror what has happened in Massachusetts over the past 5 years--last 8 years but on a national scale. Can you please describe in more detail what has happened over the last 8 years in Massachusetts?

Mr. CASH. I can. One of the most exciting things that happened is this growth of the clean energy sector in jobs that go all the way across the value chain that employs people who have Ph.D.'s, that employ architects, plumbers, electricians, those who come to your house to weatherize it, to put in insulation. It is across-the-board value chain job growth that happened in Massachusetts that can't be put overseas. And it has been done--the Regional Greenhouse Gas Initiative has been done using a market-based approach.

And one of the things that I find kind of interesting about the concerns that are raised is there seems to be a lack of confidence that our private sector can step up. What we have done in Massachusetts and across the Northeast is set a clear target, clear market rules, and the private sector has stepped up with innovation after innovation after innovation seeking to capture that world market where we know there is going to be greater demand for electricity in China, and India, et cetera. I am not sure why we want to cede that, cede the growth to India, China, Germany in terms of innovation, entrepreneurship, and economic development. That is what our country is founded on and that is what this kind of regulatory package will allow, the unleashing of that kind of entrepreneurial spirit.

The other piece that I think has been fundamentally important is our use of energy efficiency, and perhaps at

some later point I can talk more about that because that is savings across the board, residential customers and business customers as well.

Ms. JOHNSON. Thank you. My time is expired. Thank you very much.

Chairwoman LUMMIS. I thank you very much.

I recognize the gentleman from Arizona, Mr. Schweikert.

Mr. SCHWEIKERT. Thank you, Madam Chairman.

This is one of those occasions where you have dozens of questions and only a few minutes to do it in, so let me grind into a couple things that I fret about. For my panel, who has actually worked at the EPA? My understanding is in the modeling that the modeling is ultimately proprietary to the EPA, is that correct?

Mr. HOLMSTEAD. I think it is actually proprietary to an EPA contractor.

Mr. SCHWEIKERT. How do you make public policy and not have that model available for everyone to vet and make sure that--because who knows? Is it stringent enough; is it too stringent? Is there noise in the model? I am trying to understand from, you know, a discussion at the state level to the industry level to the activist level, how do you make public policy on a proprietary model?

Mr. HOLMSTEAD. Well, that question has been raised many times. EPA's answer is, well, you can have your own models

and model the same thing, and in fact if you pay a lot of money, there is a way to have the same contractor run something similar. But here is what I would say. For most of these models, the big issue is the assumptions that go into them and it is pretty easy to be skeptical of EPA's assumptions without necessarily--so I agree with your question but just take a look at the assumptions that they do acknowledge publicly and you will see how unrealistic they are.

Mr. SCHWEIKERT. Yeah. And I want to make it very clear for my brothers and sisters on the committee and everyone else in the room, when I say model, I actually mean from the raw data sets because we also know if you all remember your basic statistics class, that is where you get to really, you know, mess with your inputs.

And this one just sort of eats at me so I might as well share it and get it off my chest. An article from a couple months ago, EPA Chief promotes--or, excuse me, ''EPA Chief Promises to Go after Republicans Who Question Agency Science.'' And in the article it makes it very clear. I love this quote. ''We're coming for you.'' So if you question the data, question the science, they are going to come for us? And then the arrogance of the comments of, well, we have real scientists and if you are not part of the EPA infrastructure, you don't count as a real scientist. Is

this just noise or is this the actual arrogance that comes out of the EPA? I know it--okay--

Mr. MCCONNELL. We saw it in spades at DOE. We had opportunities to do interagency collaboration and in fact many times it was just frankly dismissed.

Mr. SCHWEIKERT. Who do I have on the panel that has actually worked at the Department of Energy?

For Department of Energy, this is your area of expertise; were you requested to build or participate or do some of the modeling? Because my understanding being from out West where, you know, we have this great difficulty trying to explain to States like Massachusetts and stuff the scale and the distances we run through and that it is more than just that facility, it is my pipelines, it is my mileage of, you know, power lines, the distances we have to cover. So a long way to ask the question, DOE, were you asked? Were you contracted for--to model the actual energy side of this?

Mr. MCCONNELL. Well, first of all, I think it is a great story that has been told here about Massachusetts. I think we all have to recognize that they are less than 1 percent of the total energy generated in the United States so it is a very unique story to a very small place. And it is a great story but it is a very small part of our world.

At DOE a simple example we got a 650-page document on Friday afternoon at 3:00 and were asked for a response back

by 10:00 a.m. on Monday. Now if my folks at DOE hadn't worked all weekend, we wouldn't have had a chance to respond, and after we responded, we barely got a thank you and many of the corrections that were made were regretfully accepted but it was the kind of disingenuous interagency collaboration that often was very puzzling.

Mr. SCHWEIKERT. And so you are saying from a technical standpoint the relationship DOE and EPA--I mean how did they react when you provided them those corrections to the data?

Mr. MCCONNELL. Reluctant acceptance, but in fact I think it was more of a box-checking exercise to show that interagency collaboration occurred when it really didn't.

Mr. SCHWEIKERT. Okay. Thank you, Madam Chairman.

Chairwoman LUMMIS. The gentleman yields back.

The Chair now recognizes the gentlelady from Oregon, Ms. Bonamici.

Ms. BONAMICI. Thank you very much, Madam Chairwoman. And thank you to the witnesses for appearing here today.

This is an issue that is a high priority for my constituents, and before I go into questions, I just wanted to say a few words about the economic arguments we are hearing today. I know that a lot of my fellow committee members have heard me rave about Oregon and I do realize that in some ways we face different conditions from the conditions experienced by some of my colleagues. In Oregon, for

example, we are currently phasing out our last coal-fired power plant. We have abundant hydroelectric power and that means that the reduction target given to our State by the EPA is quite a bit different from targets given to States that rely on coal power for electricity.

But I also want to say that Oregon's economy is uniquely reliant on natural resources, and hence, our economy is threatened by the impacts of climate change. My constituents see the cost of inaction as startlingly high. We consider what might happen to our wine industry, for example, if the global temperatures continue to rise, what is happening to our commercial fishing and shellfish industry as the ocean chemistry changes because of high levels of carbon dioxide in the atmosphere.

And so while the EPA's proposed rule is being analyzed by the State Departments of Environmental Quality, our utility sector, and others who will participate in its implementation, they are seeing forward progress in carbon reduction as welcome news in Oregon.

And I know, Commissioner Cash, you spoke about RGGI. I just want to mention that our Pacific Coast Collaborative has worked on a Pacific Coast Action Plan on Climate and Energy, and that is a collaboration among not only States, the States of California, Oregon, and Washington, but also British Columbia to combat climate change. And our region is really

becoming a center of innovation and investment in the clean fuels and technologies.

And I know, Mr. McConnell, you mentioned the importance of developing new technologies, attracting private capital for infrastructure. All of this is turning into jobs, as you, Dr. Cash, recognized was happening in Massachusetts.

So even though, yes, Massachusetts is just one, as Mr. McConnell recognized, one State, when we look at the regional partnerships that are being implemented and moving forward, I think we see a lot of potential to have the same kind of results that they have seen in Massachusetts on a regional scale.

So I wonder, Dr. Cash, could you talk a little bit--it was an interesting discussion about collaboration or the alleged lack thereof with the EPA. Can you recommend any improvements that could have been made to the outreach process but also talk about whether your agency and others in the RGGI group were consulted during the development of the proposed rule?

Mr. CASH. Thank you very much. That is an excellent question and I am glad I have an opportunity to respond.

I think in the development of the rule there was actually a lot of outreach, and it wasn't just to States like Massachusetts. My understanding from talking to colleagues when I was in--a member of NARUC as a Commissioner--Public

Utilities Commissioner, was that the EPA reached out quite a bit all across the country from the highest level--Commissioner level down to the staff level, that the inputs into models and to how they analyze this was done with a lot of input from States, from other agencies as well. The Department of Energy, et cetera, was very engaged in this as well.

So I think that kind of process was a very robust one and has continued to be a robust one since the rule was announced that EPA has been holding meetings at--through all of their regions and our staff has been in contact with the technical staff at EPA almost nonstop. So that outreach has definitely been there.

In terms of the regional concern, I knew it might be addressed that Massachusetts is a small State. I get that. But part of what has happened in RGGI is that it hasn't been just our State. It hasn't just been the 1 percent. It has been all of the RGGI States, the New England States down to the mid-Atlantic States, down to Maryland and Delaware have been part of this. And all across that region, which is a significant amount of population in the country, a significant amount of the energy use, a significant mix of different energy sources, we have seen reductions of 40 percent while the regional economic advances by 7 percent. And we have seen this huge growth in the innovation sector of

the--in--all across these States. And it is actually not just these States. We see this throughout the--all of the United States.

Ms. BONAMICI. Thank you, Dr. Cash.

And in my remaining few seconds, I just want to mention that, you know, we have had many discussions about the development of technology in the committee and also in the Environment Subcommittee on which I am the Ranking Member. We have had hearings about this issue. And I want to point out that historically, if you look at the development of technology, there is a lot more incentive for the companies to develop technology and for investment in the development of technology when there is a requirement that the technology is--there is a demand for it. So when there is a requirement, then the technology is developed. If it is not required, there is not as much incentive for the development of that technology.

So I yield back. I am over time. I yield back. Thank you, Madam Chairwoman.

Chairwoman LUMMIS. I thank the gentlelady.

The Chair now recognizes the gentleman from Oklahoma, Mr. Bridenstine.

Mr. BRIDENSTINE. Thank you, Madam Chair.

First of all, I would like to thank the whole panel for being here and thank you for your time and your service. I

would especially like to thank Mr. McConnell for your great service to my alma mater Rice University and it is--while we may not win many football games, we have got some amazing technical research capabilities and I am glad you are there to help us with those things.

When President Obama was a candidate in 2008, he pledged to the San Francisco Chronicle that he would bankrupt the coal industry. These rules from the EPA are nothing more than his attempt to fulfill this campaign promise. When you look at the practical effects that this rule will have, no other conclusion can be made than this president is trying to kill coal.

As several of you mentioned in your testimonies and what I have heard from utilities and co-ops back in Oklahoma, the assumptions the EPA made regarding efficiency improvements were utterly unrealistic. The timeline for implementation was egregiously short and electricity prices will go up, particularly in States like mine, the State of Oklahoma, who rely heavily on coal.

Last year, coal-fired power plants accounted for nearly 60 percent of electricity generation in the State of Oklahoma, and because of that, we enjoy rates that are well under the national average. This is why I find the EPA's claims of unprecedented outreach to stakeholders to be rather egregious, because if they did, they obviously ignored

feedback that they got from my part of the country in Oklahoma.

Further, as we have heard, this plan amounts to the EPA remaking the electricity system in each State, something that has never been under the purview of this agency. There are other federal agencies with expertise in this area, namely, DOE. And I am interested if they were ever approached by the EPA regarding this aspect of electricity generation.

Mr. McConnell, as a former member of this Administration, what can you tell me about the nature of interagency collaboration under this President?

Mr. MCCONNELL. Well, I think, as I had mentioned earlier, it was an awkward dance because very often the inconvenient truths of technical evaluation didn't fit the political agenda and that made it very difficult to actually have any collaboration, and in fact, as time went on, the communications became almost zero.

I think the other thing that I would like to respond to as well earlier about technology is that if we truly have an administration that believes in an all-of-the-above energy strategy and we really want to do something about the environment because we have been talking about that a lot today about climate change and everything else, I believe it is an important topic as well, but passing this regulation isn't going to do anything about the climate change. That is

what is so strange about all of this conversation.

And to the point of if we want to do something about it, what we have to do is invest in clean technologies to enable the fuels that we are using that can be reliable and affordable for not only our country but for the rest of the world, we need to get on with that task, not defund the fossil energy organization at DOE while everything else gets the money for the windmills and the solar panels. It is a difficult conversation. It is hard to understand.

Mr. BRIDENSTINE. For the record, can you--what--how much was the fossil part of DOE? How much was that cut during your time there?

Mr. MCCONNELL. Well, it got to the point where it was on and all over the--the period of time during my tenure it was about 40 percent per year, and most recently, some of the continued work that has come in you see the cuts continuing. So it is not an all-of-the-above strategy by any stretch.

Mr. BRIDENSTINE. So when you say they were cutting research opportunities for fossil, were the other opportunities for wind and solar, were they being cut at 40 percent per year as well?

Mr. MCCONNELL. No, not at all. The DOE budget was continually increased during that entire time, and so the fundamentals around the technology that are so important around carbon capture, utilization, and storage, to promote

the ability to put technology in place that people will want to use, not to legislatively make them use, is a huge transition. It drives a market, it drives an opportunity, and it also opens up global acceptance for technology rather than trying to moralize with the rest of the world so they will do what we tell them to do.

Mr. BRIDENSTINE. Thank you, Madam Chair. I yield back.

Chairwoman LUMMIS. I thank the gentleman.

The Chair now recognizes the gentlelady from Florida, Ms. Wilson.

Ms. WILSON. Thank you so much, Chairman Lummis, for holding this hearing, and thank you to our witnesses for being here today.

I am from Florida and Florida is ground zero for climate change in America. Because of our location and geography, Floridians feel the effect of climate change more than any other region of the United States. We see firsthand the results of rising sea levels as seawater floods onto the streets of Miami. We feel the effects of increasingly powerful, increasingly common hurricanes and tropical storms that batter our State every year. On top of these devastating effects, climate change is quickly eroding Florida's beaches. These effects of climate change have caused millions and millions of dollars of damage to Florida's infrastructure, as well as reducing the number of

tourists visiting Florida, further hurting our economy.

These impacts are here and we feel them now, yet we know that even more are coming. We have to act now. Pretending this is not a serious problem and delaying the hard decisions will make it--climate change more expensive and more difficult to deal with in the future. Frankly, we owe our children and grandchildren better than kicking the problem down the road for them to deal with.

That is why I applaud President Obama and the EPA for proposing the Clean Power Plan. This plan will prevent 140,000 to 150,000 asthma attacks in children. It will also prevent thousands of premature deaths. The Clean Power Plan is the result of unprecedented proposal outreach by the EPA, which engaged a broad range of stakeholders in developing this plan. As a result of this outreach, the Clean Power Plan provides States with broad flexibility to design plans that reflect the individual policy objectives of the State and reflects its own unique circumstances.

By implementing this plan, the United States can lead the international community in efforts to address climate change while growing our clean energy sector and improving our economy. Done correctly, addressing climate change will create jobs and we should be about creating jobs. In fact, jobs, jobs, jobs should be the mantra of this Congress.

Climate change is no longer just a theory; it is our

reality. So I implore my fellow Members of Congress to support this plan and help address climate change for future generations.

Madam Chair, I have a question.

Dr. Cash, can you talk about your experiences in Massachusetts, what you have done, and I would like to know how your State's successes could be able to be duplicated in Florida and around the country. And also talk about the regional initiatives, what benefits they present and how to best encourage more States to adopt these initiatives.

Mr. CASH. Thank you very much, Ms. Wilson. A couple of comments on that.

Again, I want to go back to the comment I made about low-hanging fruit. Almost without this regulatory package it seems like there is huge opportunities on energy efficiency. Again, this is not something particular to Massachusetts. Yes, we have old housing stock but there is old housing stock all throughout the country that were not built to high energy efficiency codes. And so energy efficiency is essentially something that puts money back in the pockets of ratepayers. I still don't really understand why that isn't seen as the first fuel. Before coal, before natural gas, before wind and solar, we should be looking at energy efficiency as the first fuel and that is something that I know that in Florida there have already been advances made, particularly on the demand

response side on those hot, hot summer days when people can opt to turn down their air-conditioners a little bit and they make money on that and that reduces cost for everybody in the system.

The other point is I have often wondered about the Sunshine State and solar energy in the Sunshine State. And you are talking about jobs, jobs, jobs. If there were policies that advanced solar in Florida the way that it does in Massachusetts, in New Jersey, in California, and many, many other States now, I think that we would see many more installation jobs, electrician jobs, et cetera, and all of that would work to decrease the amount of demand that is on the whole system and make the system more reliable, not less reliable.

Chairwoman LUMMIS. The gentlelady yields back.

The Chair recognizes the gentleman from New York, Mr. Collins.

Mr. COLLINS. Thank you, Madam Chair.

Mr. McConnell, you and I share a couple things, both engineers, both MBAs. I have also spent my life in the energy industry starting with Westinghouse Electric. My background is in nuclear, it is in coal, it is in gas. I even owned a wind company for a while in the late '70s. We were producing components for the new-found wind energy driven solely by tax credits where none of the wind turbines

even worked. So I have got extensive--almost 30 plus years in that area.

So let me just start with a sign in my office, ''In God We Trust, All Others Bring Data.''

So as you have pointed out what you saw in the DOE was a political agenda. I think that is obvious. So if I could--before I run through some things, just to address Dr. Cash for a minute, I just looked up some data. RGGI--I am from New York, setting aside Alaska and Hawaii, setting them aside--they are pretty unique--let me tell you the 8 most expensive States in this country for electricity. They are Massachusetts, Connecticut, New York, Rhode Island, Vermont, New Hampshire, New Jersey, and Maine. I think they are all RGGI States. So let's call it out for what it is.

Mr. McConnell, you have got a lot of experience and I think some of what I will say is probably rhetorical but I think it is good to put it on the record. If the United States didn't produce any industrial CO2, none whatsoever, no power plants, no nothing, I have heard that that might reduce the total CO2 produced in the world by about 2 percent. Is that correct?

Mr. MCCONNELL. Yeah.

Mr. COLLINS. So to answer the gentlewoman from Oregon, if the United States didn't have any coal-producing power plants, no gas power plants, no automobiles, no nothing, at

best it might help Oregon, even if you accept that, by 2 percent maybe, sort of. In other words, this is a political agenda. I think it is obvious to anyone when you look at the data.

If I look at the different costs of producing electricity, nuclear, coal, gas, hydro, and then throw in wind and solar, wind and solar is the most expensive, two times, four times, eight times. So is it safe to say the only reason we have a wind and solar energy is tax subsidies? Absent those, you wouldn't have them?

Mr. MCCONNELL. Yes, that is right.

Mr. COLLINS. Is it also a statement of fact, rhetorical question, that every last dollar we spend, whether it is on tax subsidies or not is borrowed from China? So isn't it fair to say we are borrowing from China money so our neighbors can put solar panels on their house? Is that a fair statement? You are chuckling but it is. I mean rhetorically if every last dollar is borrowed and solar and wind only exist, only exist on subsidies, if we did not have tax subsidies, there wouldn't be a single solar panel or wind turbine going up in the United States of America, and it has been that way since the 1970s and I was part of that back in the 1970s where the joke was the wind turbine manufacturers put up the wind turbine. Back then, they were putting wooden blades on the wind turbines pretending they would work. They

get their tax subsidy and laugh all the way to the bank. That is how this industry started. It is still there. They do work today. Technology has come a long way, but my view is the government exists to help develop technology, not to pick winners and losers. This is a political agenda. The States that we just talked about are these RGGI States, the most expensive in the country, and we talk about jobs, jobs, and jobs, the cost of energy is a major part of it.

So in the remaining minute, carbon sequester, which I know quite a bit about, you are going to pump the CO2 into the ground, quite deeply into the ground, and you are going to cap it, is that a proven technology as in understanding the potential--we talk about the environment--the potential environmental consequences of pumping CO2 into the ground?

Mr. MCCONNELL. No, it is not a proven technology inasmuch as carbon capture and storage as a waste disposal of CO2. But I can offer you some encouraging thoughts. CO2 has been used for enhanced oil recovery in this country for well over 50 years. When it goes into the formation, it brings up additional oil that otherwise wouldn't come up, and in the process of doing so, in those geological formations it also is safely and permanently stored and has been in many areas across this country and in Canada as well.

It is a market-based opportunity to utilize CO2 and safely and permanently store it. Our challenge is to broadly

deploy this in other places across our country and frankly the world. The technology behind that is part of what the Department of Energy has tried to bring forward, and to declare it ready today is disingenuous. It is not.

Mr. COLLINS. Well--

Mr. MCCONNELL. But the technology needs to be developed so it can be.

Mr. COLLINS. My time is expired but I would make one closing statement. And as the county executive in Erie County, when the environmentalists--as the environmentalists talk about fighting CO2 emissions, then--and they don't like hydrofracking because we are creating hydrofracking down in the earth, these same folks, I don't know how they can support carbon sequester, pumping gas down in there. And I can tell you as the county executive, I did not allow that to proceed in our county right on the Great Lakes, one of the greatest freshwater bodies in America where they wanted to carbon sequester. I said not under my watch. But the same environmentalists that seem to care about the environment don't like hydrofracking sit there and say let's sequester carbon underground next to the Great Lakes. It makes no sense to me. I yield back.

Chairwoman LUMMIS. The gentleman's time is expired.

The Chair now recognizes the gentlewoman from Connecticut, Ms. Esty.

Ms. ESTY. Thank you, Madam Chairman.

And to Dr. Cash, welcome from a fellow RGGI State in Connecticut. Glad to have you here.

There are two topics I would like to discuss. One is electrical reliability, the reliability of the grid for those of us in the Northeast and what we went through with Sandy and other storms, that is the first topic. And the other is on the impact on consumers, again, as has been mentioned by my colleagues. Connecticut and Massachusetts and New York are high-cost States for virtually everything, I can assure you. Electricity is not alone among those.

So first turning to reliability, I know we have found in Connecticut where I know a little bit about the electrical situation that by the low-hanging fruit, the economizing efforts we have been undertaking, we have been able to take pressure off the grid at precisely those times when there has been most demand, those August days when thunderstorms roll through. Could you talk a little bit about the RGGI experience, your own in Massachusetts and with your colleagues throughout the RGGI States of how that intersection between what we have been able to do and how that impacts an aging infrastructure and frankly national security concerns about reliability of the grid?

Mr. CASH. Thank you, Representative Esty. Excellent questions.

On the reliability side what has happened is in part the RGGI funds that have come from the RGGI program, so from the generators, has gone essentially to customers who can use those funds for energy efficiency programs. And that is customers across the board, residential customers, businesses, commercial entities, those whose bottom line is very important. And I forget which Member mentioned that energy costs are a very important part of the business bottom line for companies. And what they have done is availed themselves of those revenues and used them for better lighting, weatherization, getting out old motors and getting variable speed motors, all getting huge savings.

And what that has led to is a remarkable thing in the Northeast, which is we have load growth of 2 to 3 percent, would have load growth of 2 to 3 percent because our economy is growing, people are buying more laptops, more cell phones, all that kind of stuff, and what we have essentially done by our energy efficiency programs--so again giving money back to the customers to retrofit their homes--is we have come to zero load growth, so same economic development, zero load growth. And that means we have avoided building 2,000 megawatts of new energy, new generation. No more transmission lines for those, no new generation, 2,000 megawatts, huge savings. So--and that has made the system more reliable, right? So on the hot summer day you don't

need all that.

And so that is one way, and the other is by the use of solar, which, as you mentioned, is working at that peak time of day. And we think that as solar becomes more expansive in the Northeast, we will see even more and more of that.

Ms. ESTY. Well, let's turn to consumers and the cost. We find I can say in Connecticut where I am working very hard to bring manufacturing back because I know my colleagues in Massachusetts are as well, there tends to be an obsession with the kilowatt hour cost as opposed to the actual--and how much is your energy costing if you are using less energy than your overall cost is lower?

And just to give you an example, FuelCell Energy based in Danbury, Connecticut, is benefiting from some of these targeted investments on basic R&D. They are finding it is cheaper for them to produce in Danbury, Connecticut, massive fuel cells that they are shipping to Korea. They are shipping to Korea from Connecticut because it is in fact cheaper because our productivity is so high--

Mr. CASH. Um-hum.

Ms. ESTY. --and they can produce a product that the Koreans are very happy to reduce their reliance on other fuel sources. So I think it is just an example of again it is the all-in cost.

Can you talk a little bit--first, I would like to

introduce into the record if I can, Madam Chairman, the Analysis Group report that you referenced in your testimony. I would like to submit that for the record because I think that provides more detailed--could you describe on the consumer's end communities in Massachusetts how this has impacted the bottom line of the bills they pay, not the kilowatt hour cost but the bills they end up paying?

Mr. CASH. Well, actually, the story is really good on both those counts. As I mentioned before, our rates have dropped by about 8 percent in the RGGI region. Even if they had gone up by the 1 to 2 percent that was predicted, it would have meant lower bills. So higher rates, but because less is being demanded and the price of energy would be lower and less energy being used, the bills across the region would be lower as well.

And I absolutely concede the point that Mr. Collins was raising before about the RGGI States having the most expensive electricity in the country, that is absolutely true. And by the way, you and I share something. I was--born and grew up in New York, more downstate, and that was one of the driving reasons that we got engaged in this, for the cost savings. And as I mentioned, it has led to cost savings, not cost increases. We have seen across the board these cost increases even with renewable energy, which at the beginning has been more expensive. Onshore wind, though, is

not more expensive now. We see that throughout the country. We see that in Texas where it is competitive. And we see that in New England where it is competitive. And solar has been dropping by 30 to 40 percent.

And while you mentioned the subsidies that are now received, of course we have historical subsidies to fossil fuels that go back 100 years. So clearly the playing field is not level for renewables at this point, and these subsidies at both States and the Federal Government are doing, or trying to, get that level playing field so we can see the kind of cost reductions both on rates and bills that this kind of regulation and what state activities are doing throughout the country are reaping for their customers.

Chairwoman LUMMIS. The gentlewoman's time is expired.

Ms. ESTY. Thank you.

Chairwoman LUMMIS. And without objection her submission will be entered in the record.

[The information follows:]

********** COMMITTEE INSERT **********

Chairwoman LUMMIS. The Chair now recognizes the gentleman from Texas, Mr. Weber.

Mr. WEBER. Thank you, Madam Chair.

Earlier, one of you all said in your testimony that these rules were applying to 49 States I think. Was that you, Mr. Holmstead?

Mr. HOLMSTEAD. Yes, that is right.

Mr. WEBER. And what State is it they don't apply to?

Mr. HOLMSTEAD. You know, I can't--I think it may be Vermont--

Mr. WEBER. Is that right?

Mr. HOLMSTEAD. --because Vermont doesn't have any coal-fired power plants, any even legacy plants. So I think it is only 49 States and the District of Columbia that are covered.

Mr. WEBER. I got you. I got you. Well, I was hoping you were going to say Texas because, you know, Texas has its own grid and we get things right in Texas and we are part of that lower--the rate that I think Chris Collins beat me to the punch on. I was going to bring that out.

You were talking about CO2 carbon capture sequestration. Do any of you all know where the only really huge facility with the carbon capture sequestration is?

Mr. Sopkin--is it Sopkin--where would that be?

Mr. SOPKIN. I believe you are referring to the Kemper

facility in Mississippi or not?

Mr. WEBER. No.

Mr. SOPKIN. Okay.

Mr. WEBER. They are in the process of a building that--

Mr. SOPKIN. That is right.

Mr. WEBER. --right now at huge cost overruns incidentally.

It would happen to be in Port Arthur, Texas. Would you like to guess whose district that is in? That is in my district. It was at a cost of about $400 million; 60 percent of that was supplied by the DOE. You want to talk about a nice subsidy? Sixty percent of that 400 and something million so it was like 200 and--what would that be, 240 or 50 million dollars by the Department of Energy through the American Reinvestment and Recovery Act.

How many of you all think that is duplicable in the private industry? Anybody? Mr. Cash?

Mr. CASH. Are you asking does the Federal Government subsidize the private industry--

Mr. WEBER. I won't--

Mr. CASH. Is that what you mean? I am unclear on your question. I am sorry.

Mr. WEBER. I thought that was pretty clear.

Mr. CASH. Okay.

Mr. WEBER. How many of you think it is duplicable in

the private industry without the subsidies?

Mr. CASH. No, there are clearly some things that are not ready for the market--

Mr. WEBER. Right.

Mr. CASH. --and there is no question that throughout the history of this country the Federal Government has stepped in to--

Mr. WEBER. Okay.

Mr. CASH. --provide subsidies, and fossil fuels--

Mr. WEBER. Right.

Mr. CASH. --is one of them.

Mr. WEBER. And I want to point that out that in my district we have firsthand experience of that. EOR, enhanced oil recovery, there is a company in--down in our area that does a lot of that. They do an absolute lot of that enhanced oil recovery, so we know how it works, Chuck, in our area.

I do want to go back to some of the data and the stuff, the rules, and I--Mr. McConnell, you said you worked for the DOE. When the rules were being formulated by the EPA regarding this, did they seek--were you able to give input in that?

Mr. MCCONNELL. The point that I am trying to make is that a true collaborative effort would have been considerably different than what I observed.

Mr. WEBER. Okay.

Mr. MCCONNELL. And I observed what was a box-checking exercise to say that it occurred but in fact was de minimis.

Mr. WEBER. But were you personally able to give input in there or were you prevented from doing that?

Mr. MCCONNELL. We were able to make inputs and never able to actually observe whether they were received and entered. It was simply a communication and then at that point the EPA was fundamentally in charge with whatever they wanted to report.

Mr. WEBER. So that is what you are calling you just checked the box and you never knew what they did with that?

Mr. MCCONNELL. Well, I didn't check the box; the EPA did because they were required to do ''interagency collaboration.''

Mr. WEBER. And that was their method?

Mr. MCCONNELL. Yes.

Mr. WEBER. And so they signed off on doing interagency collaboration.

I want to respond to some comments made from the gentlelady from Connecticut. And, Mr. Cash, you said you went after the low-hanging fruit. You wanted energy efficiency to be the first form of energy. And then of course Chris Collins brought out that you all have the most expensive electricity in the country. Is it true that in producing anything manufacturing that the more of it you

produce, the greater the economy of scale and the greater cost savings you ought to have?

Mr. CASH. Often, that is the case.

Mr. WEBER. Often or most of the time?

Mr. CASH. I don't know but I know that often that is the case, that economies of scale will mean better use of--

Mr. WEBER. So if we had less burdensome--unnecessary regulations in permitting and in production, we could actually produce more electricity and it might even be at a lower cost. Would you agree with that?

Mr. CASH. I would agree that there are situations where that is true.

Mr. WEBER. So when that impacts the elderly and those on fixed incomes or, as one of my colleagues said, well, just everything in New England is higher, it makes me realize why 1,500 people a day are moving to Texas, okay, in our area--

Mr. CASH. Um-hum.

Mr. WEBER. --which all the while if you looked at our government charts, there with the TCEQ, we are actually reducing not only our CO2 but our noxious gases.

Mr. CASH. Um-hum.

Mr. WEBER. And by the EPA's own admission--or should I say emission--70 percent of noxious gases come from non-stationary point sources or what we would call vehicles.

Mr. CASH. Yeah.

Mr. WEBER. How do you think those 1,500 people a day are getting to Texas? Cars and trucks? I am just thinking, you know. So maybe a reduction of those rules would help us actually produce power more efficiently and less costly for some of our constituents.

Madam--oh, Mr. Chair now, I yield back.

Mr. NEUGEBAUER. [Presiding] I thank the gentleman and now the gentleman from North Dakota, Mr. Cramer, is recognized for 5 minutes.

Mr. CRAMER. Thank you, Mr. Chair. Thanks to all the panelists. And it is hard to know where to begin.

I might just state for the benefit of my Texas friend that while 1,500 people move to Texas, the fastest rate of growth is in North Dakota where the price of electricity at the end of May is $8.62 a kilowatt hour, the lowest in the country, and I--while I appreciate--and by the way, I love any technology that would expand the lifespan of our coal mines and coal plants while at the same time expanding the lifespan of the Bakken crude oil so carbon capture for tertiary oil recovery is a very good technology that I hope someday is truly ready for prime time.

But we have talked about interagency or the lack of interagency collaboration, which concerns me, the lack of it, in a big way. But we have really rarely talked so far about the other obvious agency that has been ignored here and that

is the Federal Energy--or the FERC--Regulatory Commission, who I am not even sure why we would need if we have a rule like this, not to mention the NERC and the others.

I spent, as Commissioner Sopkin may know, nearly 10 years as the--as a Public Service Commissioner in North Dakota, and multistate integrated resource planning was hard enough just being multistate, but now to have to throw this into the mix, it boggles my mind how we even could do it. I am very proud of the fact that--and I am one that has resisted many times to call for a comprehensive national energy policy. We have a really good energy policy. It is called lowest cost. The dispatchers dispatch the lowest-priced electricity. It works in a market-based economy quite well. How in the world would we expect a utility like Basin Electric, for example, a rural electric cooperative, G&T, that has its own multistate challenges that doesn't answer to a state regulator, how would we--what are we to tell them? What are we to tell the States of North Dakota, South Dakota, Minnesota, and all of the others about their own integrated resource planning and how is this going to impact them, and North Dakota being an export State, major export State of electricity?

And I am going to begin with Commissioner Sopkin because your white paper, by the way, and Commissioner Gifford's work is very, very good, but maybe if you could just help me

understand how I would explain a rule like this to those that are multistate and multi--by the way, multi-resource planners?

Mr. SOPKIN. Well, I think it is difficult to explain frankly. We have looked at the rural and municipal providers across the country and they are very reliant on coal.

Mr. CRAMER. Yeah.

Mr. SOPKIN. And they have made the decision to self-determine their own resource plan. That is part of the reason to be a co-op or muni. And now they are going to have to cede their authority to the EPA and to some state agency that will then tell them how they have to plan their resources. And the big problem here is not having a balanced portfolio.

I would point to a study that just came out this week called ''The Value of U.S. Power Supply Diversity'' by IHS Energy. This is no right wing think tank here. This is a respected international organization that studies electrical issues. And this I think gives everybody a good idea of what is going to happen with this EPA plan. It looks at a base case, 2010 to 2012, and it compares to what will happen if we go to a lot of reliance on gas and renewable energy. And the cost of generating electricity will increase $93 billion per year because of that and consumer pockets are going to be lighter by $2,100 per year. I won't go through the rest of

the report, but this details the direction we are headed.

Mr. CRAMER. Well, and I know some of you are anxious, and Dr. Cash--but I want to get to the efficiency issue as well because we talk about energy efficiency like it is free, and I mean we have a lot of legacy sunk investment that is going to be--the costs are going to be recovered. If we don't use it, it is still going to be recovered. And if we add another resource to it, there is--the legacy stuff still has to be recovered. How do we deal even with energy efficiency and ignore the requirement to recover costs? I mean, you know, I listened to my colleague talking about, yes, the price per kilowatt hour is much higher but the bills are lower and you have said the same thing. We still have to recover costs for things that are being built, don't we? Are we ignoring that in this rule?

Mr. CASH. I don't think that we are ignoring that, and I think that there are a lot of lessons to be gained from two past historical things. One is the acid rain program, which then layered this other thing on top of least cost, and the grids, whether they be state only or regional like PJM or state only like Texas, et cetera, modified the market so that least cost bid stack took into account whatever requirements were required for acid rain, and likewise in the RGGI region where we have ISO New England, NISO and PJM, we layered that on top, and what we have seen is the market respond. The

market has responded with innovation, with better technologies, with energy efficiency that even has happened in the requirement for--

Mr. CRAMER. I don't want the rule to get ahead of the technology, and that is what I am afraid we are--

Mr. NEUGEBAUER. I ask unanimous consent that the report that Mr. Sopkin was referring to in his testimony be a part of the record. Without objection, so ordered.

[The information follows:]

********** COMMITTEE INSERT **********

Mr. NEUGEBAUER. We now go to the gentleman from Indiana. Mr. Bucshon is recognized for 5 minutes.

Mr. BUCSHON. I thank all of you for being here. Eighty-five percent of the electrical power in Indiana comes from coal, and every coal mine in the state is in my district as well as most of the oil and natural gas. My dad was a coal miner, and that is why I am here today because of the high-paying job in the coal industry. Mom was a nurse.

I want to first of all say I was also a medical doctor prior to coming here, and I know some of the scare tactics I heard from the other side about health issues related to emission, and that is exactly what it is. It is scare tactics. You know why? Because we look at a medical study, and the first thing you look at is who paid for it. Well, the studies that are showing this type of information all paid for by left-leaning global warming advocates based on a model created by a left-leaning global warming advocate who has a financial stake in the model and shamelessly published by a nationally known organization, which I actually talked to about this and told them I was ashamed of their information. From a health care standpoint, there is no clear data. It is scare tactics to scare the American people, and every time I hear it, it makes me very mad.

The discussion here today is not about whether the temperature of the Earth is changing. Of course it is. It

is always changing. When you look back at the history of the Earth, it has changed for hundreds of years, and you know, the other thing is, the EPA admits their current regulations will have no effect on this.

I want to follow up on what Mr. Collins was discussing about energy subsidies. First of all, I believe in an all-of-the-above policy. I think we should pursue absolutely everything. But let me tell--and Mr. Chairman, I was unanimous consent to introduce a few graphs from the Energy Information Administration and the Institute for Energy Research into the record.

Mr. NEUGEBAUER. Without objection, so ordered.

[The information follows:]

********** INSERT 8 **********

Mr. BUCSHON. Here is what the facts are, and you can see it--everyone can see it on this chart from where you are sitting--that the solar industry per kilowatt-hour is being subsidized at 1,100 times more than coal, oil and natural gas, and wind is being subsidized at over 80 times more than these others. So all of the states in the Northeast, you are welcome because the taxpayers in Indiana are paying for what is happening in your state.

In the electrical generation sector, renewable energy, 55 percent of the subsidies generated 10 percent of the electricity. Wind, 42 percent of the subsidy, 2.3 percent of the electricity generated. Fossil fuel--it is true fossil fuel gets subsidies, and it has for a long time. Sixteen percent of the subsidies but generated the largest share of electricity, 70 percent. And in this chart, solar per kilowatt-hour, $775.64, coal 64 cents. So I do think economics is part of the mix here, and we do need to look at economics. And the fact of the matter is, is that as we pursue new technology, the Federal Government should support these technologies, but we also need to recognize what the facts are about what we are doing and whether or not we can sustain this.

Mr. Cash, how close to you were brownouts in the Northeast in the cold winter we just had? And be very short because I know what the facts are.

Mr. CASH. We were not. We were not close to brownouts.

Mr. BUCSHON. Okay, because that is interesting because all the energy people in the Midwest tell me that you were within hours of brownouts based on the fact that you had plenty of natural gas, you just didn't have any pipelines to get it to where it needed to go.

Mr. CASH. We had constraints. I don't know if we were hours, but we had constraints and there were concerns.

Mr. BUCSHON. Okay. So you know, when you eliminate 40 percent of the electrical power generation in the entire United States, which is coal, which is the goal of the Administration, get used to it, American people. You are going to not have power 24 hours a day. You are going to have brownouts because the infrastructure is not there.

Mr. Sopkin, do you want to answer that question?

Mr. SOPKIN. Yeah. What happened with these polar vortices in January and February, many of the baseload plants that are soon to be retired because of EPA regulations came to the rescue. Don't take my word for it. The New York Times headline was ''coal to the rescue but maybe not next winter,'' and I offer this as well for the record.

Mr. NEUGEBAUER. Without objection, so ordered.

[The information follows:]

********** COMMITTEE INSERT **********

Mr. SOPKIN. And what happened is that 89 percent of AEP's coal fleet that is going to be retired next year had to be operated to avert brownouts, and on the subject of energy efficiency, Murray State College had signed up for interruptable program and found out to its dismay that actually you do get interrupted, and they were interrupted with 5 minutes' notice. Students had to be displaced and there was flooding at the school.

Mr. BUCSHON. Mr. Chairman, I yield back.

Mr. NEUGEBAUER. I thank the gentleman, and now the gentleman from Massachusetts, Mr. Kennedy, is recognized for 5 minutes.

Mr. KENNEDY. Thank you, Mr. Chairman.

Mr. Cash--Dr. Cash--excuse me--I want to touch base back with you about the interstate compact and the need for one from your opinion.

We have heard testimony today about several assumptions about the operations of multi-state implementation plans, but your testimony seems to indicate that many, if not all of them, are unfounded. Specifically, I believe it was Mr. Sopkin that indicated that enforcement can and should be on an interstate basis and that states should and will insist upon it. I wanted to get your thoughts as to that, and if you can tell us a little bit about what is going on in Massachusetts and RGGI.

Mr. CASH. Thank you very much, Congressman Kennedy.

Certainly, states can take actions by themselves. There is no question, and many, many states across the country have on energy efficiency and other programs. There are many states that avail themselves to solar programs, not just the Northeast, in fact, many in the Southwest. But what is advantageous to an interstate compact, it allows the program to move forward in the most cost-effective way. If it is very costly to reduce emission in Massachusetts but there are plants in New York that can be dialed back more cheaply, you can have a tradable program to do that. That is what the neoconservative economists said before the acid rain debates in the 1980s and 1990s, which incidentally many environmentalists were very concerned about letting the market play here. It has worked perfectly well in acid rain, and is has worked perfectly well, that the market works in the lowest-cost way to get emission is what comes to the fore, and so by having more and more states in an interstate compact, you can have a broader market, a more liquid market that allows that kind of cost-effective economics to work.

Mr. KENNEDY. Thank you, Doctor. And building off of those comments, can you discuss a little bit--again, from your opinion and your experience with Massachusetts--about how EPA's proposed rule helps Massachusetts and will allow other RGGI states to build off the successes that you have

already seen.

Mr. CASH. Sure. So it is kind of interesting. When we were developing RGGI 10 years ago when it started, we always thought of it as a potential model for something that could happen at the national level. Again, acid rain was one of the models that had worked on the acid rain side. We thought on carbon this would be a very good approach.

Clearly, as the market gets larger, if there are more and more states that are playing this, when more and more states playing it, it means that there is going to be more innovation and more competition to get that next new energy efficiency or solar product or advancement that is going to drive the cost down and reduce emission, and we see that already. The states that are very engaged in the clean energy sector, there is enormous growth and innovation, and so the larger the market is, the more advantageous it is and the lower the cost will be for emissions reduction. In fact, the cost is negative. In other words, we are saying money.

Mr. KENNEDY. Thank you, Doctor.

Mr. McConnell, thank you for your testimony earlier today. My in-laws actually live right down the street from your university so I have been to Houston more times than I ever thought I would be over the past several years.

Mr. MCCONNELL. You are always welcome.

Mr. KENNEDY. Thank you very, very much.

Sir, you talked about a bit earlier the lack of coordination between--communication between interstate agencies. If I am correct, you finished up your stint at the Department of Energy back in January of 2013, so you haven't actually been part of those official communications back and forth for over a year. Is that right?

Mr. MCCONNELL. Resigned in February of 2013, yes.

Mr. KENNEDY. So is it fair to say that you wouldn't be as involved and your knowledge about the extent of those communications over the course of the past year would be less than they would have been before?

Mr. MCCONNELL. That is absolutely true.

Mr. KENNEDY. Okay. Thank you, sir.

Chairman, I yield back.

Mr. NEUGEBAUER. I thank the gentleman, and now the gentleman from Alabama, Mr. Brooks, is recognized for 5 minutes.

Mr. BROOKS. Thank you, Mr. Chairman.

Mr. Sopkin, Alabama Attorney General Luther Strange recently testified to Congress that 'Since 1915, the Alabama Public Service Commission has guided intrastate electricity development so as to protect ratepayers and ensure reliability. Under EPA's proposed 111(d) guidelines, however, the Commission could continue these efforts only insomuch as they comport with EPA's greenhouse gas agenda.''

What is your opinion on whether the EPA or a public utility commission is or can do a better job of protecting ratepayer interests?

Mr. SOPKIN. I certainly think a public utility commission is the expert agency that performs the resource planning function best. This is something that most state public utility commissions do all the time, and their highest calling is for reliability and cost. They need to make sure that service is adequate and safe and rates are just and reasonable. That is found in virtually every statute in the state.

The problem with the EPA plan is, those issues now become secondary to carbon reduction, and as far as EPA flexibility on that subject, it appears that EPA is rejecting exceptions to the carbon reduction rule if a state says we have a problem with feasibility, we have a problem with cost, we have a problem with the age of the units, we have a problem with how this is going to affect our state. Section 111(d) of the statute that EPA is operating under specifically provides that states should have a flexibility to come to the EPA and ask for a case-by-case exception but page 520 of the EPA's proposed guidelines appears to reject that and say that these case-by-case exceptions should not be considered as a basis for adjusting the state emission performance goal or for relieving a state of its obligation

to develop and submit an approvable plan that achieves that goal on time. To me, that means that states have no choice but to submit to these carbon caps regardless of these issues of cost and reliability.

Mr. BROOKS. Thank you, Mr. Sopkin.

The next question is going to for Mr. Holmstead, but if anyone else has any insight, please feel free to share it after him.

I think we can all agree that overpopulated poor countries are some of the world's worst polluters and that prosperous economies empower economies and countries like America to pay for expensive pollution control equipment. That being the case, what weight does the EPA give to jobs creation and jobs destruction when the EPA imposes its rules and regulations? And I mention that in particular because in our state, Governor Bentley has made some rather strong comments recently talking about how the EPA and its rules and regulations are basically an attack on jobs in the State of Alabama and are costing us thousands of jobs that our people in the State of Alabama need. So Mr. Holmstead, what insight can you share?

Mr. HOLMSTEAD. EPA is supposed to do studies of job losses caused by Clean Air Act regulations. They have not done that so far. But here is what they do: They count the jobs that they want to create and don't look at the jobs that

are destroyed, so we have heard about all the people who are employed installing wind turbines and solar panels and all of those things, and those jobs that are created by government subsidies and government mandates. But they don't look at the jobs that are lost in other sectors and in particular the jobs that are lost because of higher energy costs. So the bottom line is, EPA doesn't really consider that.

Mr. BROOKS. Anybody else want to share any insight?

Mr. CASH. If I may, Congressman Brooks, I think that the EPA, again, like many other states that have taken on these kinds of issues, not just climate but clean energy, see job growth as a very important part of this, and whether it is primary like in the growth in our field of--in our area of solar jobs, wind jobs, or it is a secondary growth, that is, savings through energy efficiency that now stays in the pockets of customers, which stays in the pockets of businesses that can now use that for additional job growth. We see this as a big step forward in that regard.

Mr. BROOKS. Thank you. Any other comments?

Mr. MCCONNELL. I think there is a big difference between jobs in the service industries and real manufacturing and heavy industry, whether it is the petrochemical industry, refining, and some of the burdens of that. The states of Texas, Florida, Illinois, Alabama, your state, this is where 40 percent of the burden of this regulation will be borne, in

those states where there is heavy manufacturing and heavy industrial use, and that is the real critical issue here is that many of the other states that are involved with this don't feel that pain near as much.

Mr. BROOKS. Well, thank you. I would just follow up on that just for one or two comments. I would submit that manufacturing and industry are the golden eggs, and if you destroy those golden eggs, there won't be service jobs because those people who are in industry and manufacturing, their incomes are what ultimately are consumed by those who are providing services.

And then finally, inasmuch as the EPA is not--well, I am getting hammered down. I thought last I would have an extra 30 seconds. I don't. Thank you. Have a good day.

Mr. NEUGEBAUER. I thank the gentleman, and now the gentlewoman from Maryland, Ms. Edwards, is recognized for 5 minutes.

Ms. EDWARDS. Thank you very much, Mr. Chairman, and thank you to our witnesses today.

You know, it is so interesting when you are in Congress how people have different perspectives depending on the state and the district that they come from and represent and here you heard a number of different perspectives, and I guess the way I looked at this EPA rulemaking is that it offers states some flexibility to develop a plan that matches the needs and

opportunities of its state, considering the kind of industry and the challenges that that state faces. I know in Maryland, we have taken on this challenge put forward by our Governor to reduce our energy consumption by 15 percent just in a very short time by 2015.

Now, I don't know whether we are going to meet that goal. It is a really big goal. But I think it is important here when we are talking about preserving and protecting the environment, creating jobs for the 21st century, leaving a planet that our children and their grandchildren can enjoy and get the benefit of, then we should set a big goal. Maybe at the end of that time we don't meet those goals but we should try to do that. And so I have looked at this rulemaking as about flexibility.

Dr. Cash, I want to ask you about that because in his testimony, Mr. Sopkin mentions that the proposed rule places severe time constraints on states that are potentially insurmountable, given the need for state legislation, and I think we all recognize that these kind of things don't happen overnight, especially legislation, but it does appear to me that Massachusetts and other RGGI states have been able to accomplish much of what is described in the building blocks in a relatively short amount of time.

So as someone who has been instrumental in developing that legislative basis in Massachusetts that mirrors the

intent of the proposed rule, I am curious about hearing your perspective and what lessons we can learn from the successes that have been achieved by RGGI states in overcoming some of these hurdles.

Mr. CASH. Thank you very much, Congresswoman Edwards, and it has always been a pleasure to be working with Maryland and RGGI on other projects in this area.

First of all, I believe that there will be flexibility even on the legislative versus regulatory side. In RGGI, for example, not every state had to pass legislation. There were already states as Massachusetts was one of them that had the regulatory authority to become part of the market base program that is RGGI.

The other, I think, thing that is interesting is that during the RGGI process, it was a bipartisan approach, and it changed during the--there were different gubernatorial elections during the time but there were both Republican and Democratic governors during that time who saw the economic advantages and there were legislatures that were interested in moving the ball forward.

So while I think that this may be difficult for some states, I think there may be states that have regulatory authority already and I think in the face of this EPA regulation, I think legislators will see the potential opportunities and build in flexibility in their own state

rules, which is another thing that we have done in RGGI. For example, each state can apportion the allowances, the revenue that comes from allowances, in different ways. There isn't a cookie cutter way to do it. Different states have done different regulations and different laws that allow themselves to comply with what we have agreed upon to be RGGI but to do it in very different kinds of way. And so that has been a big advantage and one I think that adds to the kind of flexibility that we see here in the EPA rule.

Ms. EDWARDS. Let me just ask about that, because, I mean, there is also some criticism and we have heard it already today about the job creation potential or the negative impact on jobs, and again, I have always thought of this as, you know, here we are, we are in the early parts of the 21st century. The kind of jobs that we have now are not the kind of jobs that we had in the early part of the 20th century. So the fact that we lose jobs in some areas doesn't close off the opportunity in this new sector and a growing sector to create those jobs. Has that been part of your experience as well?

Mr. CASH. That has been part of our experience, and I just want to say very, very clearly, when any of these changes happen and the economic shifts, whether they are because of regulation or just the market, the global market changes, it is very, very difficult and in no way do we

minimize the changes that may happen in states that are more dependent on fossil fuels, et cetera. We do not minimize that at all. We have dealt with that in our state. We have had coal plant closings in our state and throughout the region, and we have actually used part of your RGGI funds to assist communities in the transition as those plants have closed down, whether they are in retraining or loss of revenue to the municipality that had the plant as a tax base. So that is something that I think needs to be taken into account.

Ms. EDWARDS. Thank you.

Mr. MCCONNELL. I would like to add a comment to--

Mr. NEUGEBAUER. I am sorry. The time of the gentlewoman is expired.

We will now go to the gentleman from California. Mr. Rohrabacher is recognized for 5 minutes.

Mr. ROHRABACHER. What would you like to add?

Mr. MCCONNELL. I would like to add that I have been somewhat stunned that we have spent so much time today talking about the states that generate 5 percent of the energy for the entire United States as a model for the rest of the United States, and I think that is the most troubling aspect of this is looking at that small subset as the model for the rest of the country, which doesn't look anything like the rest of the country.

Mr. ROHRABACHER. And I think you mentioned earlier that the same states actually have higher costs of energy than the rest of the states.

Let me just note that when jobs are really destroyed in our country and whether they are in Maryland or anywhere else, if you are--if what is being mandated is a use of what we have as wealth in a country and now it takes more wealth to do something, that means there are fewer jobs because there is not the wealth to create the jobs. That is one of those basics that we know about. One excuse would be for doing that, if you want to eliminate wealth that doesn't need to be eliminated and have the jobs there would be if public health was involved in this, and what I would like to know basically what we are talking about today are regulations that are not really aimed at public health. They are aimed at CO2 reduction. Is CO2 a threat to public health?

Mr. CASH. It is a threat to public health.

Mr. ROHRABACHER. CO2 actually is harmful to humans?

Mr. CASH. Not breathing it in but the impacts of climate change.

Mr. ROHRABACHER. Okay.

Mr. CASH. It is harmful to public health.

Mr. ROHRABACHER. That is enough of that. Let me--

Mr. CASH. And it is also--

Mr. ROHRABACHER. That is totally absurd, so CO2 is not

harmful to human beings, right? But all these other things that we can just conjure up in CO2 become hazardous to the health of human beings. Frankly, that one extra step is a big step because some people don't believe that CO2 actually is a major factor in climate change for our planet.

Let me just ask, earlier on we had a--so CO2 is not harmful to human beings' health itself. Earlier on, Mr. Collins, my colleague, asked about all of these regulations would even in the reduction of CO2 would only result in a 2 percent reduction in the production of CO2. I remember that. I am not sure who--

Mr. HOLMSTEAD. Can I just put this in context?

Mr. ROHRABACHER. Yes.

Mr. HOLMSTEAD. A study came out not that long ago that said if you assume this regulation is fully implemented by 2030--

Mr. ROHRABACHER. Yes.

Mr. HOLMSTEAD. --what would this regulation do, this massive shift in our economy. That would be equal to about 21 days of current emission from coal-fired power plants in China, and by 2030, it is projected that it would be something like 12 days.

Mr. ROHRABACHER. And we are talking about CO2 production.

Mr. HOLMSTEAD. Right, CO2 production.

Mr. ROHRABACHER. Which by the way is not harmful to people's health. The byproduct of manufacturing it can be conjured up but CO2 itself is not harmful, but this reduction of CO2 that we are talking about, this 2 percent, is not 2 percent of what mankind is producing or is it a 2 percent reduction of what CO2 represents as part of our atmosphere the 2 percent reduction, is it not? We are not talking about 2 percent of the reduction of what CO2 in the whole atmosphere. We are only talking about a 2 percent reduction in mankind's addition. Is that correct? Right.

Mr. HOLMSTEAD. Yes, it is, and to be clear about it, this specific regulation is .2 percent of the overall CO2.

Mr. ROHRABACHER. And let me note that CO2 then, we are talking about a 2 percent reduction of what some people think will have a draconian effect on our economy. That is 2 percent less than one-half of one-tenth of 1 percent of the atmosphere, not 2 percent--people will think it is 2 percent of what it is in the atmosphere of CO2. That is not what we are reducing. We are reducing the one-half of one-tenth percent of the atmosphere, okay, is CO2, and we are reducing the mankind's percent of that, which is only one-tenth of that. Is that correct? So what we are really talking about is one-tenth of one-half of 1 percent of the atmosphere that would be affected by this at all.

In order to--let me just state, CO2 again is not harmful

to people's health. Reducing it by this teeny weeny microscopic amount and hurting people's jobs, et cetera, throwing us into turmoil and restructuring our business is absurd. Thank you.

Mr. NEUGEBAUER. I thank the gentleman, and now the gentleman from Illinois, Mr. Hultgren, is recognized for 5 minutes.

Mr. HULTGREN. Thank you, Mr. Chairman. Thank you all. I want to thank the witnesses for being here. This is certainly an important hearing as we try and understand what legal authority under Section 111(d) EPA has to promulgate these rules.

With unemployment rates still disproportionately high in my State of Illinois, what my constituents are worried about is jobs. Manufacturing is a vital part of my district's economy, and this sector is one that will always be energy intensive. They have every incentive to find efficiency gains, which the industry has been actively doing, but many now fear that this was all for naught, considering that increased energy costs, especially in the short term, will end up making them pay more even though they are using less.

Mr. Holmstead, I wonder if I could address my question not you. The Clean Power Plan is comprised of two main parts, to my understanding, one, the state-specific goals to lower carbon pollution from power plants, and guidelines to

help the states develop their plans for meeting those goals. According to EPA, this framework provides states with the flexibility to choose for themselves, the best set of cost-effective reductions. How does EPA guidance under this plan compare with previous agency guidance for similar performance standards? Is it more or less flexible than the guidance EPA has provided for other sources, and what boundaries for state interpretation has EPA set for its guidance?

Mr. HOLMSTEAD. This is fundamentally different from anything EPA has ever tried to do before, so in the past when they have done guidance, the guidance says here is the kind of plants that you need to regulate, here are the things that you can do to improve the emission rate of those plants, and then states, you go out and you need to develop the standards for these individual plants. I think it is true that this provides much more flexibility than EPA has ever done before but it is flexibility to achieve a goal that can only be accomplished by making these dramatic changes in many ways. So is it flexible? Sure. But it is--someone used the analogy before, you know, they give you six gallons of gas to make it from here to California and say, you know, you are completely flexible, do that any way you want.

Mr. HULTGREN. Mr. McConnell, if I could address to you, you spoke about the lack of communication between DOE and EPA

when putting forward new rules. Earlier this year I asked EPA about their consultation with DOE regarding the technology readiness assessment for your former agency of science to technologies they develop. Their answer was alarming, and echoes your complaints. I wondered at what technology readiness level would you consider a technology to be adequately demonstrated? All of the CCS technologies were at six or below. That is my understanding.

Mr. MCCONNELL. I came here last November and testified about the new coal standards, and in fact, what is absurd about it is that EPA is taking a stance where plants that are either in construction or in engineering development have actually--are examples of demonstrated commercially available technology and declared that that technology would be commercially available in 2016 for new coal-fired power plants.

We have a roadmap and have had a roadmap for a number of years that said it was going to be available in 2020, and that also--it also required that continued funding of the program would be maintained at the then-current rates and then subsequent to that, the government and the Administration has defunded that effort, and so what we have done is, we have taken the money out of the technology development, declared it ready ahead of time. It is a somewhat disingenuous process that says you can use it, you

should use it, but you really can't, and then consequently, you are required to make another choice. It is flexibility but it really isn't flexibility.

Mr. HULTGREN. I think you kind of touched on this, but since climate is a global problem, I wonder if you could into a little bit more specifics of what technologies are we not developing right now that nations such as China would be willing to purchase? I am thinking of some of the combustion technologies that provide significant efficiency gains, which seem to be, you know, something this President is not supporting. So I wonder if you could talk a little bit more about that.

Mr. MCCONNELL. Well, many people would use--would say that clean coal and clean fossil technology is an oxymoron, and that is absolutely not true. It is demonstrated in our country we have made enormous progress, and that is when the government has worked with industry to provide that pathway forward, not to eliminate something but to actually invest in the technology so that it can be deployed.

The world's energy is going to double in the next 50 years. Ninety percent of that doubling will occur in developing countries. Those developing countries are going to use fossil fuels. EIA has already projected that 85 percent of the world's energy will be fossil energy by 2060. So we have an obligation to the rest of the world to develop

those clean technologies so we can really make an impact, not do this that doesn't impact anything while we hobble our economy.

Mr. HULTGREN. Good point. Thank you.

Thank you, Chairman. I yield back.

Mr. NEUGEBAUER. I thank the gentleman. I guess the chair has a question then.

Mr. Holmstead, by the year 2030, EPA believes that the proposed plan would allow the United States to reduce carbon emission from the power sector by 30 percent below the 2005 levels and roughly 17 percent cut from the 2013 levels. To achieve these reductions, EPA calculated a specific emission rate for each state, as you are aware of, by totaling the CO2 emissions produced by each state's EGUs and dividing it from the total amount of electricity generated by the EGUs. My home State of Texas is looking at a 39 percent cut in emissions by 2030. Is that achievable?

Mr. HOLMSTEAD. It is hard to know. We don't really have kind of good data on that. People are trying to figure that out. But what we do know is that it will be very expensive, and I think that is the--and again, there been some estimate of how expensive that may be. I think people are still trying to figure it out. This is an enormously complicated proposal. But the one thing we can say is, it certainly will put reliability at risk in some areas, and it

will be very expensive.

Mr. NEUGEBAUER. This may be a harder question. Do you believe EPA has a sound legal and technical basis for these emission rates and reduction targets for each individual state?

Mr. HOLMSTEAD. Well, that is actually an easy question. I think it is quite clear that this proposal goes far beyond anything EPA is authorized to do under the Clean Air Act, and I just think that is troubling that a regulatory agency would essentially ignore what Congress has given it authority to do.

Mr. NEUGEBAUER. And this weighting formula that came up with for these reduction goals, was that done fairly? If you were going to do it that way, that is a pretty big burden on some of the states that actually--are actually producing electricity.

Mr. HOLMSTEAD. Again, this question is a hard one because EPA went state by state and they said here is how we believe you should change your electric system, right, and they said on a state-by-state basis, we think you should, you know, shift generation this way and you should do energy efficiency programs and you should mandate renewable energy. So it is hard to know if it is fair. What we do know is, EPA went state by state and said here is the way we believe you should change your electricity system.

Mr. MCCONNELL. And I think in our State of Texas, we ought to be concerned because we generate 11 percent of the energy in this country and we are going to bear better than 20 percent of the burden for this, and specifically, the only way Texas can do this because of the pounds per megawatt-hour that have been mandated are going to require us to double the amount of renewable energy we have in our portfolio, approaching 35 percent in our state. So we are being punished because we are the leading renewable state in the country. The formula goes to making that a baseline for ability to move forward. So in our state, we should be very concerned.

Mr. NEUGEBAUER. I thank the gentleman. Unfortunately, the chair has to close this hearing. I want to thank the witnesses for their valuable testimony and the members for their questions. The members of the Committee may have additional questions for you, and we ask that you respond to those in writing. The record will remain open for 2 weeks for additional comments and written questions from the members.

The witnesses are excused and this hearing is adjourned. Thank you.

[Whereupon, at 12:14 p.m., the Committee was adjourned.]

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SPEAKER LISTING
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Attachment C

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

2321 RAYBURN HOUSE OFFICE BUILDING

WASHINGTON, DC 20515–6301

(202) 225–6371
www.science.house.gov

The Administration's Climate Plan: Failure by Design

Wednesday, September 17, 2014
10:00 a.m.-12:00 p.m.
2318 Rayburn House Office Building

Witnesses

The Honorable John Holdren, Director, Office of Science and Technology Policy, Executive Office of the President

Ms. Janet McCabe. Acting Assistant Administrator, Office of Air and Radiation, U.S. Environmental Protection Agency

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
FULL COMMITTEE

HEARING CHARTER

The Administration's Climate Plan: Failure by Design

Wednesday, September 17, 2014
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

PURPOSE

The Committee on Science, Space, and Technology will hold a hearing entitled *The Administration's Climate Plan: Failure by Design* on Wednesday, September 17th, in Room 2318 of the Rayburn House Office Building. The hearing will examine the role of science in the Administration's Climate Action Plan, the EPA's proposed greenhouse gas regulations for existing power plants, and other EPA rules currently under consideration by the Administration. The hearing will discuss the scientific and economic impact analyses incorporated Administration's Climate Action Plan; the scientific, technological and legal hurdles to meeting the Administration's carbon-reduction goals as well as the economic and energy security impacts of meeting those goals; and how the Administration reconciled scientific and technological concerns raised by federal science agencies, scientific advisory boards and committees, as well as the American public in formulating the Administration's Climate Action Plan and EPA's proposed greenhouse gas regulations for existing power plants among a host of other EPA regulations.

WITNESS LIST

- **The Honorable John Holdren,** Director, Office of Science and Technology Policy, Executive Office of the President
- **Ms. Janet McCabe,** Acting Assistant Administrator, Office of Air and Radiation, U.S. Environmental Protection Agency

BACKGROUND

Global Carbon Emissions

Sources of carbon emissions are global in nature. According to the Energy Information Agency (EIA), while the global emissions of carbon dioxide from the consumption of energy have increased annually, the United States has reduced emissions in recent years by over 500 million metric tons from 2007 to 2011.[1] In 2011, China emitted over 8.7 billion metric tons of

[1] U.S. Energy Information Administration, International Energy Statistics, *Available at:* http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8

carbon, accounting for over a quarter of the world's carbon pollution.[2] In 2007, the United States was responsible for roughly 20% of global emissions, but by 2011, this had dropped to 16.8%.[3]

In September 2014, the EIA released a report titled *International Energy Outlook 2014*, which documents both current and future global energy consumption and emissions.[4] Figure 1 below illustrates the historical emissions of developed countries [OECD[5]] and non-developed countries [non-OECD] since the 1990s and projects carbon emissions through 2040. The report finds that, while OECD countries like the United States have leveled or reduced emissions, non-OECD countries have contributed the largest amounts to global carbon emissions since the mid-2000s. As the graph indicates, non-OECD countries will continue to constitute an increasingly larger share of global emissions through at least 2040.[6] Non-OECD countries are estimated to account for 69% of global carbon emissions in 2040, while OECD countries will make up 31%.[7] The continued use of fossil fuels is predicted to be the major source of carbon emissions as developing countries continue to support their economic growth.[8]

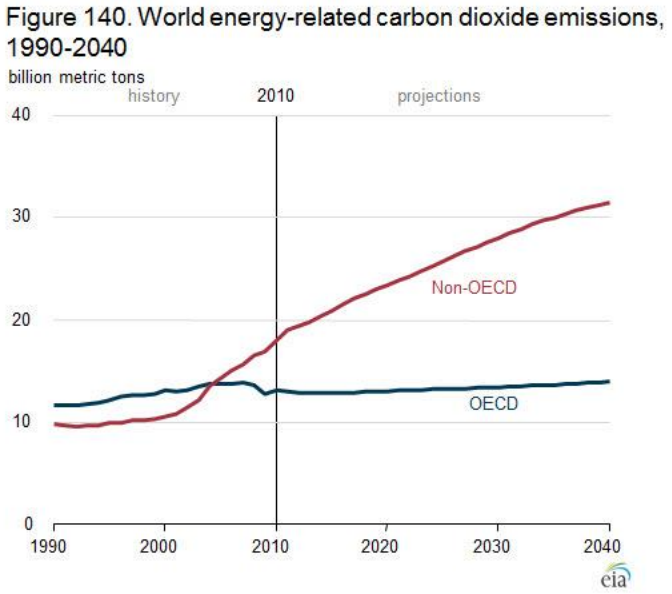

Figure 1 Source: Energy Information Administration, Available at: Energy Information Administration, *Available at* http://www.eia.gov/forecasts/ieo/pdf/0484(2014).pdf

[2] U.S. Energy Information Administration, International Energy Statistics, Available at: http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8

[3] Ibid.

[4] U.S. Energy Information Administration, International Energy Outlook 2014, *Available at:* http://www.eia.gov/forecasts/ieo/pdf/0484(2014).pdf

[5] The Organization for Economic Co-Operation Development promotes policies that improve the economic and social well-being of people around the world. Members of OECD are generally the most developed countries around the world. Non-OECD countries are generally still emerging economically. More information available at: http://www.oecd.org/about/membersandpartners/

[6] U.S. Energy Information Administration, Energy-Related Caron Dioxide Emissions, Overview, International Energy Outlook 2014, *Available at* http://www.eia.gov/forecasts/ieo/emissions.cfm

[7] Ibid.

[8] Ibid.

The President's Climate Action Plan

The White House released the President's Climate Action Plan in June 2013. The plan outlines various executive actions that the President and his Administration plan to take to reduce carbon pollution in America, prepare the United States for the impacts of climate change, and lead international efforts to combat climate change. [9]

In the Climate Action Plan, the President proposes to issue regulations and technology based standards to reduce carbon emissions.[10] This year EPA proposed regulations on new and existing power plants.[11] EPA has plans to issue regulations for refineries and other industry sectors.[12]

The plan also supports a goal of doubling renewable electricity generation by 2020[13] and modernizing the electric grid.[14] In addition, the plan takes aim at the transportation sector, building on passenger vehicle fuel economy standards by increasing standards for heavy-duty vehicles.[15] Likewise, the plan proposes to reduce greenhouse gas emissions from homes, businesses, and factories through new energy efficiency standards.[16]

The President's Climate Action Plan outlines initiatives to prepare America for the impacts of climate change.[17] The plan establishes state, local, and tribal task forces on climate preparedness.[18] The plan proposes to protect our economy and natural resources by identifying vulnerabilities of key sectors to climate change. It also promotes land and water conservation, agricultural sustainability, drought management, reduction of wildfire risks, and preparations for future floods.[19]

The plan also proposes to work with other countries to help take action to address climate change through multilateral engagements with major world economies and expanding bilateral cooperation with major emerging economies.[20] Finally, the President's Climate Action Plan will lead efforts to address climate change through international negotiations, specifically the United Nations Framework Convention on Climate Change.[21]

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[9] Executive Office of the President, The President's Climate Action Plan, June 2013, *Available at:* http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf
[10] Ibid, Page 6.
[11] U.S. Environmental Protection Agency, Regulatory Actions, Carbon Pollution Standards, *Available at:* http://www2.epa.gov/carbon-pollution-standards/regulatory-actions
[12] U.S. Environmental Protection Agency, Regulatory Agendas and Regulatory Plans, *Available at:* http://www2.epa.gov/laws-regulations/regulatory-agendas-and-regulatory-plans#background
[13] Executive Office of the President, The President's Climate Action Plan, June 2013, Page 6.
[14] Ibid, Page 7.
[15] Ibid, Page 8.
[16] Ibid, Page 9.
[17] Ibid, Page 12.
[18] Ibid, Page 14.
[19] Ibid, Page 15.
[20] Ibid. Page 17.
[21] Ibid. Page 21.

EPA Regulations

Following the Supreme Court's 5-4 decision in *Massachusetts v. EPA*,[22] the Agency promulgated numerous standards and proposed rules aimed at reducing greenhouse gas (GHG) emissions. These include:

- 2009 *Endangerment Finding*, where "EPA determined that greenhouse gases endanger the health and welfare of Americans;"[23]
- *Light Duty Vehicle Rule*, in which "EPA coordinated with the National Highway Traffic Safety Administration to develop harmonized regulations to reduce greenhouse gas emissions and improve the fuel economy of light-duty vehicles;"[24] and
- *Tailoring Rule*, where "EPA set greenhouse gas emission thresholds to define when permits under the New Source Review Prevention Significant Deterioration (PSD) and title V Operating Permit programs are required for new and existing industrial facilities."[25]

Climate science—and regulatory actions informed by such science—are among the most complex and controversial issues facing policymakers. President Obama has increasingly signaled his intention to propose significant, new executive actions and regulatory measures aimed at addressing climate concerns.[26]

According to EPA, power plants are the Nation's largest source of carbon pollution and "account for roughly one-third of all domestic greenhouse gas emissions in the United States."[27] (See Figure 2)

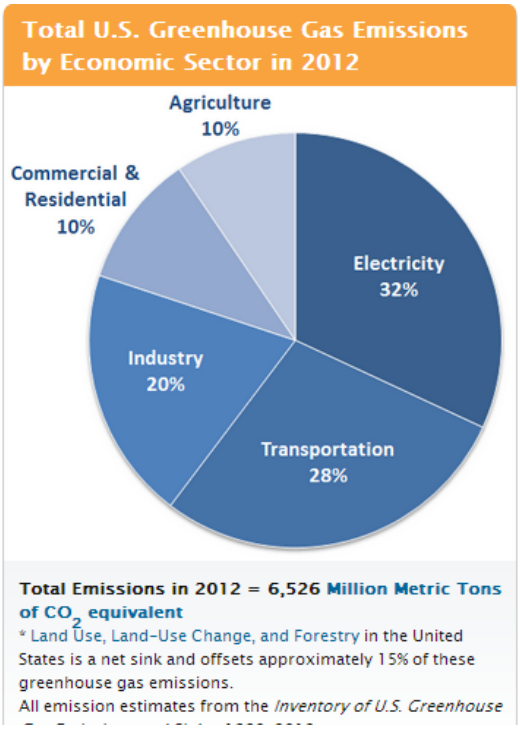

Figure 2. Source: U.S. EPA *Available at* http://www.epa.gov/climatechange/ghgemissions/sources.html

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[22] Massachusetts v. U.S. Environmental Protection Agency, 549 U.S. 497 (2007) *available at:* http://www.supremecourt.gov/opinions/06pdf/05-1120.pdf.

[23] U.S. Environmental Protection Agency, "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule." Dec. 2009. A*vailable at:* http://www.gpo.gov/fdsys/pkg/FR-2009-12-15/pdf/E9-29537.pdf.

[24] U.S. Environmental Protection Agency, "Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards; Final Rule." May 2010. *Available at:* http://www.gpo.gov/fdsys/pkg/FR-2010-05-07/pdf/2010-8159.pdf.

[25] *See e.g.* U.S. Environmental Protection Agency. "Prevention of Significant Deterioration and Title V Greenhouse gas Tailoring Rule Step 3 and GHG Plant wide Applicability Limits; Final Rule" July 2012. *Available at:* http://www.gpo.gov/fdsys/pkg/FR-2012-07-12/pdf/2012-16704.pdf.

[26] See: http://www.whitehouse.gov/the-press-office/2013/06/25/remarks-president-climate-change and http://www.whitehouse.gov/climate-change for examples.

[27] U.S. Environmental Protection Agency, News Release, June 2014, *Available at:* http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/5bb6d20668b9a18485257ceb00490c98!OpenDocument

POWER PLANT REGULATORY CONTEXT

Section 111 of the Clean Air Act (CAA) establishes a unique technology-based mechanism for controlling emissions from "stationary sources" (i.e., power plants). Section 111 provides authority for EPA to promulgate standards which apply to new and modified sources. Specifically, EPA is directed to set standards based on "the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost. . .) the Administrator determines has been adequately demonstrated."[28] In setting the standard, EPA is given some flexibility in that "emission limits may be established either for equipment within a facility or for an entire facility."[29]

Section 111 lays out different approaches for new and existing sources. Under Section 111(b), the EPA has the authority to develop a "federal program to address new, modified and reconstructed sources by establishing standards of performance."[30] In contrast, EPA explains that "section 111(d) of the Act requires states to develop plans for *existing* sources of noncriteria pollutants (i.e., a pollutant for which there is no national ambient air quality standard) whenever EPA promulgates a standard for a new source."[31]

New Power Plants

EPA first proposed a New Source Performance Standards (NSPS) for emissions for carbon dioxide (CO2) from power plants in April 2012. However, after more than 2.5 million comments on the original proposal, EPA decided that a new approach was warranted and rescinded the original proposal.[32] Consequently, on September 20, 2013 Administrator Gina McCarthy announced EPA's re-proposed CO2 NSPS for new fossil fuel-based electric generating units (EGUs).

Under EPA's NSPS proposal, the Agency concluded that Carbon Capture and Storage (CCS) has been adequately demonstrated as a technology for controlling CO2 emissions in full-scale commercial applications at coal-fired EGUs, while reaching the opposite conclusion—that CCS is not adequately demonstrated—in the case of gas-fired EGUs. Based on this determination, EPA proposed an emissions limit for coal-fired sources of 1,100 lb CO2/MWH and proposed standards for natural gas combined cycle sources from 1,000 to 1,100 lb CO2/MWH depending on the size and type of unit. EPA did not include modified and reconstructed plants in the proposed rule. EGUs that primarily fire biomass are exempted from

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[28] Clean Air Act § 111(a)(1), 42 USCA § 7411(a)(1) (2006).

[29] U.S. Environmental Protection Agency, Background on Establishing New Source Performance Standards Under the Clean Air Act, *Available at:* http://www2.epa.gov/sites/production/files/2013-09/documents/111background.pdf

[30] U.S. Environmental Protection Agency, Fact Sheet: Reducing Carbon Pollution From Power Plants, *Available at:* http://www2.epa.gov/sites/production/files/2013-09/documents/20130920technicalfactsheet.pdf

[31] U.S. Environmental Protection Agency, Region 7 Air Program, Section 111(d) Plans, *Available at:* http://www.epa.gov/Region7/air/rules/111d.htm

[32] Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, Proposed Rule, Preamble p. 14-5, Sep. 20, 2013. *Available at:* https://www.federalregister.gov/articles/2014/01/08/2013-28668/standards-of-performance-for-greenhouse-gas-emissions-from-new-stationary-sources-electric-utility#h-18

the proposed rule.[33] Find more information on CCS and EPA's carbon rules in hearing held last March: http://science.house.gov/hearing/subcommittee-energy-and-subcommittee-environment-joint-hearing-science-capture-and-storage.

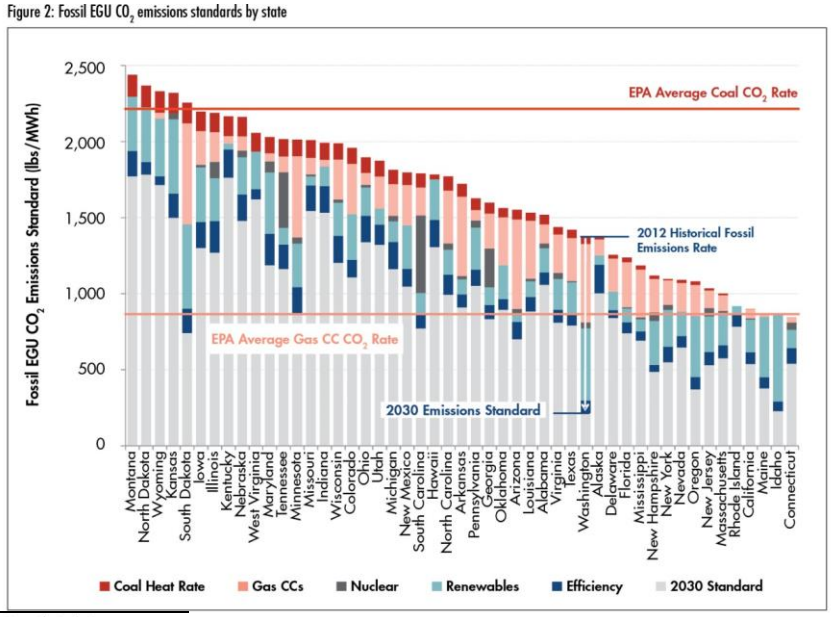
Existing Power Plants

On June 2, 2014, EPA issued its "Clean Power Plan" under section 111(d), which addressed carbon emissions from existing fossil-fueled power plants. Just prior to EPA's release, President Obama made these regulations the focus of his Weekly Radio Address.[34]

EPA explains the key difference between section 111(d), for existing power plants, and 111(b) for new and modified plants: "Section 111(d)'s mechanism for regulating existing sources differs from the one that CAA section 111(b) provides for new sources because CAA section 111(d) contemplates states submitting plans that establish 'standards of performance' for the affected sources and that contain other measures to implement and enforce those standards."[35]

The Agency believes the proposed Clean Power Plan will "lower the carbon intensity of power generation in the United States by approximately 30% in 2030 from carbon dioxide emissions levels in 2005. The agency predicts that under the Clean Power Plan, electricity bills will decline by "roughly 8 percent"[36] and that the amount of U.S. electricity generated by coal-fired EGUs will decline by at least 25%. To achieve this goal, EPA is giving each state a numerical carbon reduction target, based on the state's existing power generation portfolio."[37] (See Figure 3.)

Figure 2: Fossil EGU CO_2 emissions standards by state



Source: The Brattle Group

[33] *Id.* at 30, fn. 8.

[34] http://www.whitehouse.gov/blog/2014/05/31/weekly-address-reducing-carbon-pollution-our-power-plants

[35] U.S. Environmental Protection Agency, *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, Proposed Rule, 79 FR 34832, June 2, 2014.

[36] U.S. Environmental Protection Agency, News Release, June 2014, *Available at:* http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/5bb6d20668b9a18485257ceb00490c98!OpenDocument

[37] Congressional Research Service, *EPA's Proposed Greenhouse Gas Regulations: Implications for the Electric Power Sector*. June 23, 2014. *Available at:* http://www.crs.gov/pdfloader/R43621.

Specifically, EPA set each state's required level of carbon reduction assuming that each state could recognize a set level of carbon reductions through the use of four "building blocks." Broadly speaking, the four blocks encompass:[38]

1. Installing technologies to increase efficiency at power plants.
2. Giving Natural Gas Combined-Cycle plants priority over steam-boilers.
3. Building new renewable power generation.
4. End-user efficiency technologies and programs that reduce power demand.

EPA proposes that these building blocks represent the "best system of emissions reduction" that has been adequately demonstrated for fossil-fuel power plants regulated under the EPA rule.

According to EPA, the proposed rule will be "implemented through a state-federal partnership under which states identify a path forward using either current or new electricity production and pollution control policies to meet the goals of the proposed program. The proposal provides guidelines for states to develop plans to meet state-specific goals to reduce carbon pollution and gives them the flexibility to design a program that makes the most sense for their unique situation."[39]

Modified Power Plants

On the same day as the 111(d) "Clean Power Plan," EPA also unveiled a separate 111(b) "Modified Source Proposal," in which EPA explained:

> *For more than four decades, the EPA has used its authority under CAA section 111 to set cost-effective emission standards that ensure newly constructed, reconstructed and modified stationary sources use the best performing technologies to limit emissions of harmful air pollutants. In this proposal, the EPA is following the same well-established interpretation and application of the law under CAA section 111 to address GHG emissions from modified and reconstructed fossil fuel-fired electric steam generating units and natural gas-fires stationary combustion turbines.*[40]

The proposed rule for Modified Sources only applies to fossil-fueled power plants that undergo major modifications or reconstruction. In contrast with the broad approach EPA utilized for existing power plants, this proposal identifies a "combination of best operating practices and equipment upgrades" as the "best system of emission reduction" and arrives at a unit specific standard requiring 2% efficiency gains.

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[38] U.S. Environmental Protection Agency, *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, Proposed Rule, 79 FR 34832, June 2, 2014.

[39] U.S. Environmental Protection Agency, News Release, June 2014, *Available at:* http://yosemite.epa.gov/opa/admpress.nsf/bd4379a92ceceeac8525735900400c27/5bb6d20668b9a18485257ceb00490c98!OpenDocument

[40] U.S. Environmental Protection Agency, "Carbon Pollution Standards for Modified and Reconstructed Stationary Sources: Electric Utility Generating Units; Proposed Rule." June 2014. *Available at:* http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13725.pdf.

ADDITIONAL READING

CONGRESSIONAL RESEARCH SERVICE. *Climate Change and Existing Law: A Survey of Legal Issues Past, Present, and Future.* March 10, 2014. *Available at* http://www.crs.gov/pdfloader/R42613.

CONGRESSIONAL RESEARCH SERVICE. *EPA's Proposed Greenhouse Gas Regulations: Implications for the Electric Power Sector*. June 23, 2014. *Available at* http://www.crs.gov/pdfloader/R43621.

CONGRESSIONAL RESEARCH SERVICE. *EPA's Proposed Greenhouse Gas Regulations for Existing Power Plants: Frequently Asked Questions*. July 3, 2014. *Available at* http://www.crs.gov/pdfloader/R43572 .

U.S. ENVIRONMENTAL PROTECTION AGENCY. *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, Proposed Rule. 79 FR 34832. June 2014. *Available at* http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule.

U.S. ENVIRONMENTAL PROTECTION AGENCY. *Carbon Pollution Standards for Modified and Reconstructed Stationary Sources: Electric Utility Generating Units, Proposed Rule*. 79 FR 34960. June 2014. *Available at* http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13725.pdf.

U.S. ENVIRONMENTAL PROTECTION AGENCY. *Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, Proposed Rule.* 40 CFR Part 60. Sep. 20, 2013. *Available at* http://www2.epa.gov/carbon-pollution-standards/2013-proposed-carbon-pollution-standard-new-power-plants.

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
CHAIRMAN LAMAR SMITH

For Immediate Release
September 17, 2014

Media Contacts: Zachary Kurz
(202) 225-6371

Statement of Chairman Lamar Smith (R-Texas)
Hearing on The Administration's Climate Plan: Failure by Design

Chairman Smith: Today we look at one of the most aggressive new government programs in our country's history. The Obama Administration calls it the Climate Action Plan.

It empowers the Departments of Interior, Energy, Agriculture, Defense, Transportation, Housing and Urban Development, Health and Human Services, National Institute of Standards and Technologies, NOAA, FEMA, the U.S. Army Corps of Engineers, and the EPA to implement broad climate policies and programs with great cost and little benefit to the American people.

The cornerstone of the White House sweeping Climate Action Plan is EPA's power plant regulation. Extending well beyond the power plants themselves, this rule will increase the cost of electricity and the cost of doing business. It will make it harder for the American people to make ends meet.

In fact, EPA's own data show us that its power plant regulation would eliminate less than one percent of global carbon emissions. Analysis shows this would reduce sea level rise by the thickness of a mere three sheets of paper.

EPA's mandates will be difficult for states to meet even under ideal circumstances. If energy prices or energy demand escalate, the costs of meeting those mandates will soar and American families will be forced to pay the bill.

Charles McConnell, a former Assistant Secretary for Energy appointed by President Obama, has taken the Administration to task for creating a plan doomed to fail. In a recent op-ed, Mr. McConnell asks, "Have we lost our minds? Has this administration convinced itself that it can … mandate something that is fundamentally useless? Does the EPA think the American public and global community are not capable of seeing the illusion for what it is?"

What's clear is that by eliminating affordable, reliable power options, the regulation will increase the energy prices for the majority of Americans. That means everything will cost more – from electricity to gasoline to food. Higher costs will drive companies out of business, kill good jobs, and leave even more Americans unemployed.

Until this Administration can propose a detailed strategy, tell us the total cost, and show us exactly what we will get for the sacrifice—we are just asking the American people to waste their money.

America cannot afford to drive its economy over a cliff with the hopes that the rest of the world will make the same mistake. The only economy the EPA's plan will help is that of our competitors.

OPENING STATEMENT

Ranking Member Eddie Bernice Johnson (D-TX)
Committee on Science, Space, and Technology

"The Administration's Climate Plan: Failure by Design"

September 17, 2014

Thank you, Mr. Chairman. I'd like to extend a warm welcome to our witnesses, Dr. Holdren and Ms. McCabe. Thank you both for being here this morning. It is nice to see you again and I appreciate you taking the time to appear before us today. This morning we are going to discuss the President's Climate Action Plan and a part of that plan, a proposal by the Environmental Protection Agency to cut carbon emissions from the largest source of those emissions – power plants.

I'd like to begin by noting the title given to this morning's hearing by my Republican colleagues, "The Administration's Climate Plan: Failure by Design." "Failure by design," is an ironic choice of words considering my colleagues' preferred alternative appears to be doing nothing and hiding our collective heads in the sand. We all know that such inaction will not solve anything, and it certainly won't stop the Earth from warming. In my opinion, the Majority's "do nothing" plan is the real example of "failure by design."

I also know that some still question whether climate change is real, but surely we are now beyond debating that question. Reports based on the work of the world's top scientists such as the U.S. National Climate Assessment and those from the U.N. Intergovernmental Panel on Climate Change have sent a stark message to our nation's leaders and the international community, namely: the adverse effects of climate change are evident today and require immediate action or these adverse effects will grow dramatically worse.

To be fair, in trying to understand a phenomenon of this magnitude, the job of science will never be done. It will continue to evolve. We must always keep looking for new answers, replacing opinions with data, and projections with observations. We must continue to innovate in how we predict, measure, prevent, and adapt to climate change. That is the nature of science and of our stewardship of the planet.

However, we in Congress have to acknowledge that we are not the experts, and that allowing partisan politics to distort the scientific understanding of climate change is cynical and short-sighted. We may not agree on where the uncertainties within climate science lie, but we should all be able to understand that vast and avoidable uncertainties will remain if we stop the progress of climate research.

Experts from industry, academia, and every level of government are calling on us to help prepare our communities for the threats they face due to climate change. We must answer their call and act.

Cutting carbon emissions from the power sector is critical to any effort to address climate change, and that is why I am supportive of the EPA's Clean Power Plan. EPA's proposal, like the rest of the President's Climate Action Plan, is the bold step forward our nation needs. It gives states the flexibility to develop innovative policies that cater to regional differences. It is based on strategies already in use such as improving energy efficiency and encouraging the development of renewables.

Let us be clear: EPA is not imposing a specific set of measures. States will choose what goes into their plans and they can work alone or as part of a multi-state effort to achieve meaningful reductions. These are common-sense steps that will lead to a healthier environment, because acting on climate change is not only an environmental imperative, but a public health and economic one as well.

Among the many health concerns, greater risk of asthma attacks, heat stroke, and respiratory disease are all consequences of a warming climate. Likewise, energy demand, agricultural production, labor productivity, and the risks to coastal properties are just a few of the economic areas where climate change has already taken, and will continue to take, its toll.

We as a nation must act today to address climate change if we are to preserve our quality of life for our children and grandchildren. The negative consequences of climate change are not abstract scientific predictions for the far-off future. We are facing some of these consequences now and they are affecting every American. I look forward to working with this Administration as it puts forward policies like the Clean Power Plan and the Climate Action Plan, which will ensure a vibrant future economy and a safe and healthy environment. Thank you, and I yield back.

Statement of Dr. John P. Holdren
Director, Office of Science and Technology Policy
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to the
Committee on Science, Space, and Technology
of the
U.S. House of Representatives
on
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The Science Supporting the Climate Action Plan

Chairman Smith, Ranking Member Johnson, and Members of the Committee, I am pleased to be here with you today to discuss the ways in which the Federal Government has incorporated and continues to incorporate rigorous scientific information, insights, and analyses from a diversity of credible bodies into the formulation and implementation of President Obama's Climate Action Plan[1]—hereinafter CAP—to cut carbon pollution in America, prepare the United States for the impacts of climate change, and lead international efforts to address the global climate-change challenge.

The CAP rests, most fundamentally, on scientific and technological understandings, analyses, and judgments in three categories: (1) the natural science of anthropogenic climate change and its impacts on human well-being; (2) technological analysis of the possibilities (including both current status and future prospects) for climate-change mitigation—meaning measures to reduce the pace and ultimate magnitude of the changes in climate that occur—and for increasing preparedness for and resilience against the changes in climate that mitigation fails to avoid; and (3) the economics associated with estimating (a) the costs of mitigation and preparedness/ resilience measures at various levels of implementation and (b) the costs of the harm to human well-being that is not avoided by either mitigation or improved preparedness and resilience.

There is an immense amount of primary, peer-reviewed, published research in all three of these categories, and syntheses characterizing the states of knowledge about them have been and continue to be carried out by a wide variety of competent national and international bodies (including Federal agencies and scientific advisory boards and committees reporting to them). Important examples include the comprehensive reviews by the U.S. National Academies[2] and the Intergovernmental Panel on Climate Change (IPCC)[3], the recent joint review by the U.S. National Academy of Sciences and the U.K.'s Royal Society of London[4], the Second and Third U.S. National Climate Assessments[5], the annual State of the Climate reports of the U.S. National

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[1] President Obama's *Climate Action Plan*, 2013, accessible at: http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

[2] The National Academies reports on climate change include the four-volume set, *America's Climate Choices* (2010) and a host of other reports completed since 2010, all accessible at: http://nas-sites.org/americasclimatechoices/.

[3] Intergovernmental Panel on Climate Change (IPCC) 2007 and 2013-2014 IPCC Fourth and Fifth Assessments, accessible at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

[4] Climate Change: Evidence and Causes – An Overview from the Royal Society and the U.S. National Academy of Sciences, 2014: http://dels.nas.edu/resources/static-assets/exec-office-other/climate-change-full.pdf

[5] *Global Climate Change Impacts in the United States*, 2009: http://nca2009.globalchange.gov and *Climate Change Impacts in the United States*, 2014: http://nca2014.globalchange.gov.

Oceanic and Atmospheric Administration[6], the periodic synthesis and assessment reports of the U.S. Global Change Research Program[7], and the first Quadrennial Energy Technology Review of the U.S. Department of Energy.[8] Notably, the U.S. National Climate Assessments, which are required under the Global Change Research Act of 1990, reflect substantial input from the public, outside experts and stakeholders. The most recent such Assessment, which was released in May of 2014, was the result of a three-year analytical effort by a team of over 300 climate scientists and experts, informed by inputs gathered through more than 70 technical workshops and stakeholder listening sessions held across the country. The resulting product was subjected to extensive review by the public and by scientific experts inside and outside of government.

These syntheses and many more were drawn upon in the interagency effort, led by the Executive Office of the President (EOP), which developed the elements of the CAP for the President's approval. A particularly compact and accessible digest of the relevant state of knowledge as of early 2013 and a set of recommendations based on it was provided to the President and the EOP in March of that year by the President's Council of Advisors on Science and Technology (PCAST).[9] That report's influence on the Climate Action Plan was considerable, as any reading of the two documents will confirm.

In the remainder of this testimony, I will summarize the insights from the above-listed studies that are most germane to the Climate Action Plan, addressing all three of the science and technology categories mentioned at the outset.

The Natural Science of Anthropogenic Climate Change

Decades of observation, monitoring, and analysis have demonstrated beyond reasonable doubt that:

(1) the Earth's climate is changing at an unusual pace compared to natural changes in climate experienced in the past;
(2) emissions of carbon dioxide and other greenhouse gases from human activities, principally the combustion of fossil fuels but also land-use change, are the principal drivers of the recent and ongoing changes in climate;
(3) climate change is already causing harm in many parts of the world (and many parts of the United States);
(4) this harm will continue to grow for some time to come, because of the time lags and inertia built into the Earth's climate system and the inertia in civilization's energy system (which prevents drastically reducing the offending emissions overnight); but
(5) there is a large difference between the amount of additional harm projected to occur in the absence of vigorous remedial action versus that expected if such action is taken promptly.

The recent measured changes in climate include a multi-decade increase in the year-round, global-average air temperature near Earth's surface, but they are not limited to that. The changes

[6] National Oceanic and Atmospheric Administration (NOAA) State of the Climate reports, accessible at: http://www.ncdc.noaa.gov/sotc/
[7] http://www.globalchange.gov/browse/reports
[8] Department of Energy (DOE) 2011 Quadrennial Technology Review: http://energy.gov/sites/prod/files/QTR_report.pdf
[9] PCAST March 2013 letter report to the President on Energy and Climate: http://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_energy_and_climate_3-22-13_final.pdf

also include increased temperatures in the ocean; increased moisture in the atmosphere; increased numbers of extremely hot days; changed patterns of rainfall and snowfall; and, in some regions, increases in droughts, wildfires, and unusually powerful storms.

In consequence of the temperature increase, moreover, glaciers are melting, the Greenland and Antarctic ice sheets are losing mass, and sea-level is rising. While the pace of sea-level rise is relatively slow—the current rate would produce an increase of about a foot over a century—there are three main reasons that the problem should not be underestimated:

(1) The rate appears to be increasing and is now about twice the average for the 20th century; increases as high as 1 to 2 meters (3.3 to 6.6 feet) by 2100 cannot be ruled out.[10]
(2) Even modest amounts of sea-level increase constitute a significant threat to ecosystems and infrastructure in low-lying coastal areas, not least because of the amplification of storm surges and increased intrusion of salt water into coastal aquifers.
(3) The momentum in the processes driving sea-level rise is such that it is expected to continue for centuries even under the most optimistic scenarios for climate-change mitigation; it can be slowed, but it cannot be stopped on any time scale of practical interest.

The "fingerprint" of human responsibility for most of the climate change observed over the past few decades is unmistakable: science has established persuasively that the atmospheric build-up of the key greenhouse gases has resulted from human activities; and the spatial and temporal patterns as well as the magnitudes of the observed changes in temperature are consistent with what theory and models predict would result from that build-up, after allowance is made for the partially offsetting effect of increased atmospheric concentrations of reflective and cloud-forming particulate matter (also of human origin).

Civilization's emissions of carbon dioxide, in particular, have led not only to a build-up of the stock of this important heat-trapping gas in the atmosphere (where it's responsible for about half of the total warming influence of all the heat-trapping substances humans have added over time); those emissions have also led to an increase in the dissolution of carbon dioxide into the surface layer of the ocean. There the dissolved CO_2 forms carbonic acid (H_2CO_3) and thus lowers the pH (increases the acidity) of ocean waters. This ongoing acidification increasingly puts at risk coral reefs and other marine organisms that build their shells or skeletons from calcium carbonate (including clams, oysters, and some plankton).

The foregoing conclusions are based on an immense number of observations and measurements made by thousands of scientists at both governmental and nongovernmental institutions around the world, as well as on fundamental understandings about atmospheric physics and increasingly sophisticated computer models of ocean-atmosphere-ecosystem interactions, all recorded in tens of thousands of peer-reviewed scientific publications. These key findings about climate change have been endorsed by every major national academy of sciences in the world, including those of China, India, Russia, and Brazil as well as that of the United States, and by nearly every U.S. scientific professional society, by the World Meteorological Organization and the UN's Inter-governmental Panel on Climate Change (IPCC), and by the recently released Third U.S. National

[10] Note: The highest value cited by the IPCC's 2013 climate-science synthesis is 1 meter, but a December 2012 NOAA report put the upper limit at 2 meters (see Parris, A., P. Bromirski, V. Burkett, D. Cayan, M. Culver, J. Hall, R. Horton, K. Knuuti, R. Moss, J. Obeysekera, A. Sallenger, and J. Weiss. 2012. *Global Sea Level Rise Scenarios for the US National Climate Assessment*. NOAA Tech Memo OAR CPO-1: http://cpo.noaa.gov/sites/cpo/Reports/2012/NOAA_SLR_r3.pdf)

Climate Assessment. (Some illustrative quotations from a number of the key documents are assembled in Attachment A, submitted with this testimony.)

Elaboration on the human drivers of global climate change

Scientists have developed good estimates of the magnitudes of both human-caused and natural influences on the global climate (called "forcings" in climate science) since the start of the Industrial Revolution around 1750. The results show that the human influences in this period have far outweighed the natural forcings, as well as internal variability of the climate system. The 2013 IPCC report found, specifically, that the positive forcing (warming influence) attributable to human-caused emissions over the period 1750-2011 was about 80 times as large as the positive forcing from changes in solar irradiance (the largest natural influence) over that period. Studies going back 20 years and more show that increases in globally-averaged temperatures over the last several decades have been too rapid and too sustained to be a result of internal climate variability.

Carbon dioxide (CO_2) is the most important greenhouse gas emitted by humans. Emissions of CO_2 between 1750 and 2011 accounted for 42 percent of the total positive forcings resulting from all human emissions over this period; and current CO_2 emissions are responsible for around 75 percent of the century-scale Global Warming Potential (GWP) of all current human emissions of heat-trapping substances.[11]

In 2012, about 90 percent of global anthropogenic CO_2 emissions came from fossil-fuel combustion and cement production (40% coal, 30% oil, 16% natural gas, 4% cement) and 10 percent from deforestation and other land-use change. Of the "industrial" (fossil fuel and cement) emissions in that year, China accounted for about 29%, the United States for about 15%, the 27 countries of the European Union for about 11%, India for about 6 percent, Russia for about 5 percent, and Japan for about 4 percent. These relatively few countries alone, then, accounted for about 70 percent of global industrial CO_2 emissions in 2012.

The second most important greenhouse gas emitted by humans is methane (CH_4). It has a far shorter atmospheric lifetime than that of carbon dioxide, but methane emissions between 1750 and 2011 nonetheless accounted for about 24 percent of the total positive forcings resulting from all human emissions over this period. Part of this contribution is because chemical reactions involving CH_4 lead to increases in tropospheric ozone and stratospheric water vapor. The activities responsible for civilization's methane emissions are, approximately: fossil-fuel

[11] Note: The GWP of an initial emissions pulse of a greenhouse gas is calculated by summing its warming effects over a specified number of years into the future. Because different greenhouse gases have different lifetimes in the atmosphere, the relative importance of their respective emissions at a given time—as measured by GWP—depends on the length of time chosen for those sums. One hundred years is a common choice. Note also that the IPCC's new approach to allocating the responsibility for forcing (as of the 2013-14 assessment) is based on the contribution of emissions of the heat-trapping substances and their precursors between 1750 and 2011, not on the changes in concentrations of the heat-trapping substances as was the approach in the IPCC's previous assessments. The two approaches to allocation give somewhat different numbers because emissions of some substances affect not only their own concentrations but also the concentrations of others.

production, processing and transport, 30%; animal husbandry, 27%; waste management, 23%; rice cultivation, 10%; and biomass burning, 10%.[12]

Emissions of halogen gases (leaked from a variety of commercial products and industrial uses) accounted for another 9% of the total positive forcing as of 2011, compared to 1750, but about 40 percent of the positive forcing from the halogen gases was cancelled out by the reduction in the stratospheric concentration of ozone caused by their emissions. Emissions of nitrous oxide (from combustion and fertilizer use) contributed about 4% of the total positive forcing up to 2011.

The other major contributor to positive forcing since the beginning of the Industrial Revolution is not a greenhouse gas at all but "black carbon"—heat-absorbing particles emitted primarily by biomass burning and by many two-stroke and diesel engines. Although the atmospheric lifetime of these particles is only days to weeks, their emissions had contributed about 16% of all positive forcing as of 2011, compared to 1750.

The positive forcings from the sources just mentioned are currently being partially offset by negative forcing that comes from reflective and cloud-forming particles that also have increased in concentration in the industrial era. The main sources of these particles are certain oxides of sulfur and nitrogen emitted by fuel combustion. There are strong incentives to reduce those emissions for reasons of public health and the protection of ecosystems from acid precipitation, however, and when this happen the resulting reduction of negative forcing by the associated reflective and cloud-forming particles will "unmask" some of the warming that currently is being offset.

Elaboration on the link between climate change and extreme weather

Weather is what is happening in the atmosphere (temperature, pressure, humidity, wind, precipitation) at a particular time and a particular place. Climate is the pattern exhibited by the weather at a particular place (or region, or the world as a whole) over a period of decades, expressed in terms of average values of weather variables day and night at different times of the year, as well as the statistics of deviations (magnitude and frequency) from these averages.

In general, one cannot say with confidence that an individual extreme weather event (or weather-related event)—for example, a heat wave, drought, flood, powerful storm, or large wildfire—was caused by global climate change. Such events usually result from the convergence of multiple factors, and these kinds of events occurred with some frequency before the onset of the discernible, largely human-caused changes in global climate in the late 20th and early 21st centuries. But there is much evidence demonstrating that extreme weather events of many kinds are beginning to be influenced— in magnitude or frequency—by changes in climate.[13]

[12] Note: There are large natural sources that add carbon dioxide and methane to the atmosphere and large natural sinks that remove these gases. It is the human sources that have led to an imbalance in sources and sinks overall, however, leading to the build-ups of the atmospheric concentrations of these two gases. The same is true of nitrous oxide. There are no large natural sources of halogen gases, however, and the limited natural sinks for many of these lead to very long atmospheric lifetimes for many of those emitted by human activities.

[13] Note: Increases in magnitude or frequency of extremes that range far beyond historical experience can be attributed to climate change with very high confidence. For example, an analysis provided by the UN's World Meteorological Organization with its 2014 assessment of global climate in the preceding year showed that the

The manifestations of these changes in climate are observable almost everywhere:

- The atmosphere has become warmer, averaged over the year, for the world as a whole and in all but a few individual locations, and it has become wetter (the absolute humidity has increased), averaged over the year, for the world as a whole and in many regions.
- Ocean surface temperatures have risen, averaged over the year, for the world as a whole and in most places, and the depth of the ocean's warm surface layer has increased in some regions.
- The geographic unevenness of the warming[14] is affecting atmospheric and oceanic circulation patterns, although exactly how cannot always be sorted out, currently, from the natural variability in these patterns.

This being so, it is reasonable to say that most weather in most places is being influenced in ways modest to significant by the changes in climate that have occurred as a result of human activities.

A number of changes in extremes of weather and of weather-related events have become evident over the past few decades:

- Extremes of high temperature—both individual hot days and heat waves (periods of unusually high temperature that last for more than five consecutive days)—have become both more frequent and hotter in many regions.
- A larger fraction of total precipitation is occurring in extreme downpours in the United States and many other parts of the world. This is plausibly contributing to an increased risk of flooding in at least some regions.
- Drought has become more frequent and more severe in the American West and in some other historically drought-prone parts of the world.[15]
- Hotter and drier weather in wildfire-prone regions, coupled with earlier snowmelt, mean that the fire season starts earlier in the spring, lasts longer in the fall, and burns more acreage (although there is considerable year-to-year variability in the area burned).
- The intensity of tropical storms is up in some regions (most notably the North Atlantic) but not in others. There is reason to believe, though, that the most powerful of these storms—called hurricanes in the Atlantic and Eastern Pacific and typhoons in the Western Pacific—are becoming more powerful than they otherwise would be because of warmer sea-surface temperature, greater depth of the warm ocean surface layer, and higher atmospheric moisture, and that they also are becoming more devastating than they otherwise would be when they make landfall, because their storm surges occur on top of a mean sea level made higher by global warming.
- There is evidence that conditions conducive to severe thunderstorms are becoming more prevalent in the Eastern United States. Because of high year-to-year variability, however, one cannot say at this point whether recent observed increases in thunder-storm activity are

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Australian country-wide temperature record set in 2013 would have been "virtually impossible" as a result of natural variability alone.

[14] Note: For well understood reasons, the warming produced by the build-up of greenhouse gases is greater over land than over the oceans, and greater in the far North than in the mid-latitudes and tropics.

[15] Note: That drought can increase in some parts of a world that is getting more precipitation on the average is not a paradox. Global climate change is nonuniform. Precipitation is down in some places while up in others, and earlier melting of snowpack and higher losses of moisture to evaporation from soil and reservoirs contribute to low stream flows and soil drying in summer in many regions.

attributable to climate change. There is as yet not any evidence that tornadoes have increased in frequency or intensity as a result of global climate change.

There are good scientific explanations, moreover, supported by measurements, of the mechanisms by which the overall changes in climate resulting from the human-caused build-up of heat-trapping substances are leading to the observed changes in weather-related extremes. Accordingly, it is expected that the kinds of extremes already observed to be increasing will continue to increase in magnitude and/or frequency going forward, unless and until the build-up of heat-trapping substances driven by emissions from human activities is brought to a halt.

Elaboration on the "hiatus" in global warming

A number of climate-change contrarians have been propagating the claim that there has been no global warming since 1998. This is not correct.

Although the rate of increase in the globally and annually averaged temperature of the atmosphere near the surface has slowed since around 2000 compared to the rate of increase over the preceding three decades, near-surface warming of the atmosphere has indeed continued. The 2000s were warmer than the 1990s, and the 2010s so far have been warmer than the 2000s.

Thirteen of the 14 warmest years since decent thermometer records became available (around 1880) have occurred since 2000.[16] During the recent period in which the rate of increase of the average surface air temperature has slowed, moreover, other indicators of a warming planet—shrinkage of Arctic sea ice and mountain glaciers, increased discharges from the Greenland and Antarctic ice sheets, increased ocean temperatures, and sea-level rise—have been proceeding at or above the rates that characterized the preceding decades.

The long-term warming trend resulting from the build-up of heat-trapping gases and particles in the atmosphere is superimposed on a considerable amount of variability—year-to-year and decade-to-decade ups and downs in the global-average atmospheric temperature resulting from variations in solar output, in volcanic activity that injects reflecting particles into the stratosphere, and in ocean circulation patterns that govern how much of the trapped heat goes into the oceans as opposed to staying in the atmosphere. Scientists therefore do not expect the rate of atmospheric warming, which results from the combination of human and natural influences, to be uniform from year to year and decade to decade. Climate models show short periods of slow warming and even cooling within long-term warming epochs, much as we see recently in observations.

The reduced rate of warming since around 2000 is thought to be the result of a partial offsetting, by a combination of natural factors that tended to cool the atmosphere in this period, of the warming influence of the continuing greenhouse-gas build-up. An increase in emissions of sunlight-reflecting particles from an increase in global coal use may also have contributed. Among the natural factors thought to be involved, oceans are likely to have played a major role

[16] Note: The one year in the top 14 that occurred prior to 2000 was 1998. It was the third or fourth warmest year since 1880 as a result of an unusually powerful El Niño, which boosted the global-average surface temperature well above the trend line. The recent rate of temperature increase can be made to look smaller by "cherry-picking" the 1998 spike as the new start date for one's trend line, as a number of contrarians have done to bolster their claim that global warming has stopped.

in slowing atmospheric warming in this period. The oceans normally take up more than 90 percent of the excess heat trapped by anthropogenic greenhouse gases; thus, a small percentage increase in what goes into the ocean can take a large share away from what otherwise would have gone into the atmosphere.

When the variability that has lately slowed surface-atmosphere temperature trends next shifts to contributing warming, of course, it will then reinforce rather than offset the warming influence of the build-up of greenhouse gases. The rate of increase of the global-average surface temperature will then rebound, becoming more rapid, rather than less rapid, than the long-term average.

It is not clear, finally, that all of what has long been called "natural variability" is completely free of human influences. It's known that the geographic unevenness of anthropogenic global warming (amplified in the Northern Hemisphere by the shrinkage of Arctic sea ice, among other factors), affects atmospheric and oceanic circulation patterns. There is considerable evidence that the El Niño / La Niña cycle, as well as other patterns that affect how much trapped heat ends up in the oceans rather than in the atmosphere, are being influenced to some extent by anthropogenic global warming.

It has been suggested that the slow rate of recent warming calls into question our understanding of the importance of CO_2 in determining Earth's climate. There is no reason to believe this. Short periods of slow warming and even cooling amidst longer warming epochs are expected and are seen in instrumental records, geologic temperature reconstructions, and in climate-model output. Internal redistributions of energy (as is suspected to be responsible for most of the recent slowdown in atmospheric warming) in no way conflict with our understanding of CO_2 as a dominant driver of long-term changes in Earth's climate.

Quantitative measurements and projections

Two important questions germane to assessing how much action is warranted to address climate change are these: (1) Just how big are the changes in climate that have already occurred, measured against the yardstick of pre-industrial conditions? (2) How much bigger are the changes likely to become in the decades ahead under a range of assumptions about actions taken going forward (or the lack of them)?

Those questions are briefly addressed in what follows by reference to recent measured values of some key indicators and projections of the values those indicators are expected to reach by 2050 and 2100 under scenarios developed by the IPCC to explore the consequences of minimal versus maximal global mitigation actions going forward. The range of possibilities assessed by the IPCC is spanned by scenarios labelled RCP2.6 on the maximal-action side and RCP8.5 on the minimal-action side,[17] and these two scenarios as analyzed in the IPCC's 2013 and 2014 reports are the source of the projections provided below.

Increase in atmospheric carbon dioxide. As noted above, CO_2 is the most important of all the heat-trapping gases added directly to the atmosphere by human activities.

[17] In the IPCC's terminology, RCP stands for Representative Concentration Pathway, and the numbers represent the approximate total net forcing from anthropogenic influences in 2100 (accounting for negative as well as positive contributions) under the indicated scenario, i.e., 2.6 watts per square meter of Earth's surface in RCP2.6 and 8.5 watts per square meter in RCP8.5.

- *Measurements*. The average concentration of CO_2 in the atmosphere in 1750 was about 278 parts per million by volume (ppmv). In 2013, the corresponding figure was 396 ppmv. That's an increase of 42 percent. Ice-core studies show that the 2013 value is the highest concentration of atmospheric CO_2 experienced on Earth in the last 800,000 years.
- *Projections*. In the IPCC's minimal-action/high-emissions scenario (RCP8.5) the CO_2 concentration reaches 540 ppmv by 2050 and 936 ppmv by 2100. In the maximal-action/low-emissions scenario (RCP2.6), the figure is 421 ppmv in 2100.

Temperature. The single most informative index of the state of the global climate is the annually and globally averaged temperature of the atmosphere near Earth's surface. This average has been directly computable from thermometer measurements around the world since the late 19th century.[18]

- *Measurements*. According to the IPCC's 2013 report, the global average surface temperature for 2000-2009 was 0.78±0.06 °C (1.40±0.11°F) warmer than the average for 1850-1900.[19] The 2014 National Climate Assessment gives the increase in average surface temperature for the contiguous United States between 1895 and 2012 as 0.89±0.17 °C (1.6±0.3 °F).
- *Projections*. In the IPCC's 2013 RCP8.5 scenario, the global average surface temperature for 2046-2055 is 2.6±0.6 °C above the 1880-1899 average and for 2086-2095 it is 4.3±1.0 °C 7.6±1.8 °F) above the 1880-1899 average. For RCP2.6, the values are 1.6±0.6 °C for 2046-2065 and 1.6±0.7 °C in 2081-2100.

Sea level. Changes are not uniform across the globe, due to nonuniform heating and effects of Earth's rotation, winds and ocean currents, gravitational anomalies, and continental subsidence and uplift. The average change is informative about overall trends, however.

- *Measurements.* According to the IPCC (2013), global mean sea level in 2010 was about 0.2 meters (8 inches) higher in 2010 than in 1900, and about 0.3 meters higher than its 1750 value. The rate of increase since 1990 has been double the average for the 20th century.[20]
- *Projections.* In the IPCC's RCP8.5 scenario, the additional increase by 2100 is projected at 0.7±0.3 meters (28±13 inches), with further large increases following inevitably. For RCP2.6, the additional increase by 2100 is projected at 0.4±0.15 meters (16±6 inches). As noted above, NOAA's range of possibilities for 2100 extends even higher.

Increase in ocean acidity: Part of the excess CO_2 added to the atmosphere by human activities is absorbed by the ocean, where it combines with H_2O to make carbonic acid (H_2CO_3). The resulting increase in the acidity of sea water (decline in its pH) imperils many of the organisms that make their shells or skeletons from calcium carbonate (corals, oysters, zooplankton).

- *Measurements.* The global-average pH of ocean surface water has declined by about 0.1 pH unit since 1750, which corresponds to a 26 percent increase in hydrogen-ion concentration. (Because of regional variations in ocean chemistry, the range is 20-35 percent.)
- *Projections.* In the IPCC's RCP8.5 scenario, ocean-surface pH falls another 0.35 pH unit by 2100, corresponding to a further 2.2-fold increase in hydrogen-ion concentration. Under RCP2.6, pH in 2100 is only 0.05 units below the current value, representing a 12 percent increase in hydrogen-ion concentration compared to today.

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[18] Note that small changes in the globally averaged atmospheric temperature near the surface are associated with large changes in the spatial and temporal patterns of temperature, precipitation, etc., that constitute climate. This is clear from the substantial changes in these patterns already being observed after an increase of only 0.8°C.

[19] IPCC, *Climate Change 2013: The Physical Science Basis*, p 37.

[20] Ibid, p 49

The numbers presented above underscore a key point made by the authors of the Third U.S. National Climate Assessment:

> *As the impacts of climate change are becoming more prevalent, Americans face choices. Especially because of past emissions of long-lived heat-trapping gases, some additional climate change and related impacts are now unavoidable. This is due to the long-lived nature of many of these gases, as well as the amount of heat absorbed and retained by the oceans and other responses within the climate system. The amount of future climate change, however, will still largely be determined by choices society makes about emissions. Lower emissions of heat-trapping gases and particles mean less future warming and less-severe impacts; higher emissions mean more warming and more severe impacts.*[21]

Technological Analysis of the Possibilities for Remedial Action

Mitigation

The importance of a technology strategy to address the challenges of climate change has been recognized since the 1990s. One early and seminal study, published in 1992 by the Committee on Science, Engineering, and Public Policy (COSEPUP) of the National Academy of Sciences and National Academy of Engineering,[22] explicitly addressed technological options for reducing emissions of greenhouse gases, including CO_2, and the need for further mitigation research and development (R&D) in several categories, including energy management in residential and commercial buildings, industrial energy management, transportation energy management, and energy supply systems. These basic energy-consuming sectors of the economy have continued to form the analytical framework for proposals to mitigate the human causes of global climate change.

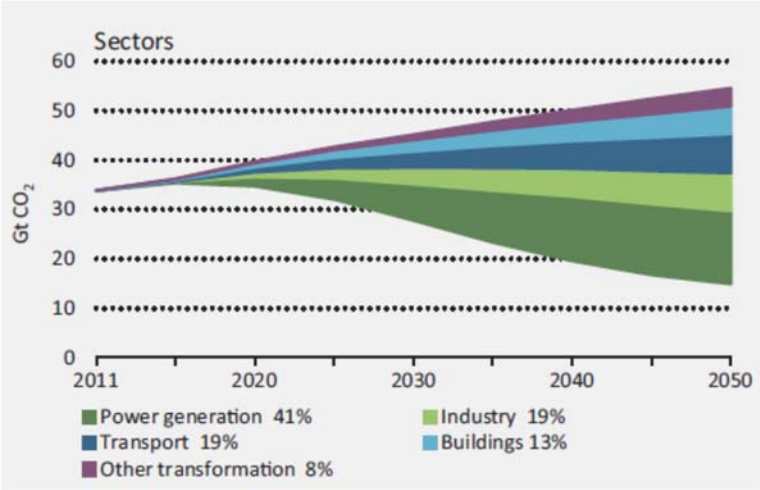
As the understanding of the potential for anthropogenic greenhouse gas emissions to cause dangerous interference with the global climate system has matured, numerous scenarios have been developed (by the IPCC, as mentioned above, and many other groups) to relate combinations of potential mitigation actions, and their effects on future emission trajectories, to the resulting changes in the projected increase in global average temperatures. One much-analyzed "business as usual" scenario, involving a continuation of current greenhouse gas emission trends, is known as the 6-Degree Scenario, because these extended current trends would result in at least a 6-degree Celsius rise in long-term global average temperatures. (Warming at 2100 would be about 4 degrees C. This scenario is similar to the IPCC's RCP8.5 scenario, described above.) This amount of global warming is widely believed to be associated with severe and irreversible impacts, such as large-scale extinctions and, over time, catastrophic sea-level rise. A second scenario, known as the 2-Degree Scenario, describes an emission trajectory that recent climate science research indicates would give at least a 50 percent chance of limiting average global temperature increases to 2 degrees Celsius, the target agreed at the 2009 Conference of the

[21] *Climate Change Impacts in the United States*, 2014 [Third U.S. National Climate Assessment], p. 13.

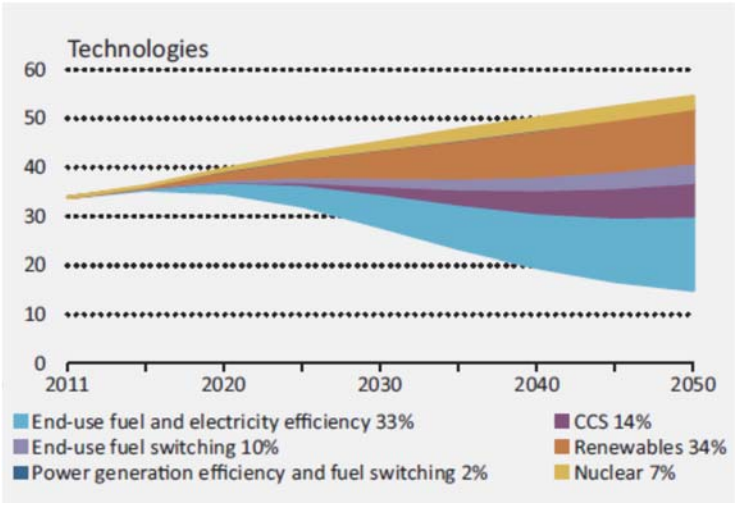
[22] Committee on Science, Engineering, and Public Policy of the National Academy of Sciences and National Academy of Engineering, *Policy Implications of Greenhouse Warming: Mitigation, Adaptation, and the Science Base*. 1992. Washington, D.C.: National Academy Press.

Parties to the UN Framework Convention on Climate Change. (This scenario resembles the IPCC's RCP2.6.)

The following figure shows the difference between emissions of greenhouse gases under the two such scenarios, as estimated by the most recent *Energy Technology Perspectives* report of the International Energy Agency (IEA). The top of the colored bands describes the likely growth of emissions out to 2050 in the 6-Degree Scenario. The bottom line represents the level of emissions needed to achieve the 2-Degree Scenario. The colored bands represent the contributions of improvements in various energy-consuming sectors to avoid the 6-Degree Scenario and achieve the 2-Degree Scenario. Like the earlier COSEPUP report, this figure shows that technological changes to avoid dangerous interference in the global climate system will require contributions from the four key energy sectors of buildings, industry, transport, and power generation.[23]



The classes of technologies that could be deployed in these sectors to achieve the 2-Degree Scenario have also been modeled by the IEA, and are depicted in the next figure.[24]



While IEA reports are not official documents of the U.S. government, they are the result of strong international technical collaboration and analysis by leading scientific and engineering

[23] International Energy Agency, *Energy Technology Perspectives 2014*, 30.
[24] *Ibid.*

experts from developed countries, including the United States. The *Energy Technology Perspective* reports and their technology roadmaps show that it is possible to construct energy pathways that are likely to avoid exceeding the 2-degree Celsius threshold for global temperature increase, while maintaining a secure and affordable energy system in the long run. The IEA even projects that its particular 2-Degree Scenario retains an important role for fossil energy in an increasingly sustainable global energy system. A variety of other authoritative analyses, including those in the IPCC's 2007 and 2013-14 reports, echo these general findings: namely, that economically and environmentally sustainable energy systems for the future can be constructed based on substantial improvements in energy efficiency and greater shares of renewable and nuclear energy, along with advanced fossil-fueled power plants with carbon capture and storage.[25]

The energy R&D programs of the U.S. Department of Energy (DOE) have long included major attention to these areas, and all of them are well represented in recent DOE budgets. In November 2011, DOE released its first-ever Quadrennial Technology Review (QTR), advocated by PCAST a year earlier[26] as a way to ensure that relevant options were all being appropriately tracked and supported to ensure their timely development to their full potential. In that review, six thrusts were deemed essential to an energy future that both strengthens U.S. competitiveness and protects the climate:

- Increase vehicle efficiency;
- Electrify the vehicle fleet;
- Deploy alternative liquid fuels;
- Increase building and industrial efficiency;
- Modernize the national electrical grid; and
- Deploy cleaner electricity sources.[27]

The Administration has strong efforts underway in each of these domains.

There is, then, a strong analytical base pointing to an array of improved and new energy technologies that can be brought to bear to reduce greenhouse-gas and black-carbon emissions in a manner that supports both energy security and economic competitiveness. That is not to say, however, that these technologies will materialize automatically in the quantities and on the time scale required. The Third National Climate Assessment highlighted the need for careful attention to the policy mechanisms that could be used to foster the development and implementation of such technologies; and analyses of the costs, benefits, tradeoffs, and synergies associated with different actions and combinations of actions to deploy them.[28] The CAP has taken those insights, too, on board and its implementation will benefit from them. It is clear, though, that technology offers possibilities for reducing emissions of heat-trapping substances even beyond what the CAP will achieve, and the science makes it clear that such further reductions will be essential. The help of Congress ultimately will be required if the full potential of technology in this domain is to be realized.

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[25] See the references cited in Footnotes 2 and 3, as well as Johansson, T.B., A. Patwardhan, N. Nakicenovic, and L. Gomez-Echeverri, *Global Energy Assessment – Toward a Sustainable Energy Future.* 2012. Cambridge University Press and the International Institute for Applied Systems Analysis.

[26] President's Council of Advisors on Science and Technology, 2010. *Report to the President on Accelerating the Pace of Change in Energy Technologies through an Integrated Federal Energy Policy*, pp 10-11.

[27] U.S. Department of Energy, 2011. *Report on the First Quadrennial Technology Review*, ii.

[28] *Climate Change Impacts in the United States*, 2014 [Third U.S. National Climate Assessment], p711.

Preparedness and resilience

Although the importance of a technology strategy for climate-change mitigation has been apparent since the 1990s, the importance of a companion technology strategy to support climate-change adaptation, preparedness, and resilience has come into view only in the last few years. The first major international study to give equal weight to mitigation and adaptation—the report of the UN Special Experts Group on Climate Change and Development[29]—came out only in 2007. The U.S. National Academies' report on *America's Climate Choices* noted in 2010 that:

> *While options available to the nation for adapting to the impacts of climate change have in many cases been identified, the scientific understanding of the effectiveness of these options is lacking, given that climate change is likely to pose challenges beyond those that have been addressed in the past as adaptations to climate variability. Thus, the need for scientific and technological advances is pervasive across the field of climate change adaptation research. ... Recently, examination of the Climate Change Science Program has shown that investment in "human dimensions research," including but not mainly oriented toward adaptation, and non-research expenditures on decision support represent about 2 percent of the total climate change research effort (NRC, 2009c). Investment in adaptation research is only a fraction of that 2 percent.*[30]

This situation has since substantially changed, as can be seen in the current 10-year strategic plan for the USGCRP, which was approved and published in 2012. Each of its four key strategic goals (i.e., advance science, inform decisions, conduct sustained assessments, and communicate and educate) focus on the needs to build and properly utilize a broad base of scientific and technological information to support adaptation actions and strategies.[31]

The technological possibilities for contributing to this goal extend across the spectrum of societal infrastructures that will be affected by a changing climate, as is described in more detail below. In these areas, as the National Research Council observed, the first technological steps towards addressing adaptation needs may be extensions of existing options for dealing with climate variability or extreme events, differing mainly in the scope of implementation, frequency of application, and the intensity of effort. It is also possible, though, that since future climate change "may well exceed the range of current climate variability and extreme events; thus, novel adaptations are very likely to be needed, especially in the event of tipping points and/or abrupt changes."[32]

A primary and general technological need associated with adapting to climate change is in the area of technologies for collecting, analyzing, and disseminating information. Enhancements to monitoring systems will be needed for adequate detection of stresses and changes in both natural systems and societal infrastructure in order to identify, at an early stage, potential needs for adaptation. For built systems, this would include an analysis of engineering thresholds of current infrastructures, so that there is a better understanding of their current resilience to climate-change

[29] UN Special Experts Group (UNSEG), *Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable*, United Nations Foundation, 2007.
[30] National Research Council, 2010. *America's Climate Choices: Adapting to the Impacts of Climate Change*, p. 203.
[31] National Science and Technology Council. *The National Global Change Research Plan 2012-2021,* p. xvi.
[32] National Research Council, 2010. *America's Climate Choices: Adapting to the Impacts of Climate Change*, p. 213.

impacts.[33] There is a related need to improve understanding of the engineering interdependencies across the infrastructures and services fundamental to a vibrant economy and the degree to which these infrastructures and these services will be altered by climate change.[34] Once this information is gathered and analyzed, there are technological challenges in ensuring that the information is synthesized and disseminated in formats that can be readily used by decision-makers in both governmental and nongovernmental settings.

With respect to specific key sectors of the U.S. economy, there is a variety of technological opportunities that could boost their resilience and meet needs created by climate changes that can no longer be avoided. The following sectoral examples illustrate some of these possibilities.

Water. As climate change increases stress on water supplies, there may be significant opportunities for new technologies that give greater insight into the real-time status of ground and surface waters,[35] as well as for technologies that would improve the efficiency of water use in applications such as energy production.[36] In some places in the world, groundwater withdrawals are leading to significant subsidence that is exposing major cities to greater flooding from rivers or the ocean. Water supply technologies that can serve as an alternative to such "groundwater mining" may help reduce the potential for flooding associated with heavy downpours or sea-level rise.[37] Opportunities also exist to utilize technology to better manage surface-water resources. For example, some water agencies are developing approaches that inform flood-control operations using improved weather forecasts and soil-moisture monitoring, in turn preserving more water for consumers to use.

Agriculture. Climate change poses a major challenge to U.S. agriculture and has already led to steps farmers have taken to adapt to changes in temperature and precipitation. The Third National Climate Assessment found that "In the longer term, however, existing adaptive technologies will likely not be sufficient to buffer the impacts of climate change without significant impacts to domestic producers, consumers, or both. New strategies for building long-term resilience include both new technologies and new institutions to facilitate appropriate, informed producer response to a changing climate."[38] Such technologies may include new forms of sustainable irrigation in agriculture;[39] developing/breeding crops that can thrive in changed ecosystems and places,[40] including salt-tolerant crops;[41] and focusing on technologies that can help marine aquaculture to adapt to increasing ocean acidification.[42]

Natural Ecosystems. Beyond the benefits of agricultural and intensely managed forest eco-systems, less intensely exploited ecosystems also provide many benefits to society, including clean water, habitat that supports valuable biodiversity, food from wild fish stocks and

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[33] National Research Council, 2010. *America's Climate Choices: Adapting to the Impacts of Climate Change*, p. 205.
[34] Water Utility Climate Alliance, 2013. "National Climate Resiliency Initiative 2013."
[35] *Climate Change Impacts in the United States*, 2014 [Third U.S. National Climate Assessment], p. 89.
[36] *Climate Change Impacts in the United States*, 2014 [Third U.S. National Climate Assessment], p. 265, 267.
[37] Brown, S., et al., 2014. "Shifting Perspectives on Coastal Impacts and Adaptation," *Nature Climate Change* 4: 752-753.
[38] *Climate Change Impacts in the United States*, 2014 [Third U.S. National Climate Assessment], p. 161.
[39] National Research Council, 2010. *America's Climate Choices: Adapting to the Impacts of Climate Change*, p. 68.
[40] *Ibid.*
[41] National Research Council, 2010. *America's Climate Choices: Adapting to the Impacts of Climate Change*, p. 210.
[42] *Climate Change Impacts in the United States*, 2014 [Third U.S. National Climate Assessment], p. 562.

aquaculture, and opportunities for tourism and recreation.[43] Such ecosystems also have the ability to enhance the resilience of communities to climate change and extreme weather. For example, salt marshes, sand dunes, and barrier islands can serve as "nature's defenses", helping to shield homes and businesses from storm surge and coastal flooding.[44] Technological approaches are being developed to enhance integration of these nature-based ("green") approaches with built ("gray") infrastructure to enhance community resilience. Technological approaches are also being developed to better observe and forecast changing ocean conditions to help resource managers and ocean industries reduce impacts and increase resilience.[45]

Transportation. The Department of Transportation (DOT), in partnership with states and communities, is already advancing integration of climate information to minimize the effects of extreme weather and climate change on critical transportation infrastructure. In 2010 and 2011, DOT's Federal Highway Administration (FHWA) supported state Departments of Transportation and Metropolitan Planning Organizations' efforts to pilot approaches for conducting climate change vulnerability and risk assessments. FHWA helped to support projects in San Francisco Bay, coastal and central New Jersey, Hampton Roads, Virginia, the State of Washington, and the Island of Oahu, Hawaii. Informed by these pilot efforts, DOT is now supporting 19 Climate Resilience Pilots across the country. In addition, DOT is working with its partners in Mobile, Alabama, to conduct a vulnerability assessment of transportation infrastructure. Results of the work, including project level engineering analyses, as well as transferable climate risk management tools for use in other locations, should be available later this year. Going forward, there may be opportunities for new materials and technologies to make transportation systems less vulnerable to damage from temperature increases and water submergence. New technologies may also help in improving the function of transportation systems for emergency response and evacuation.[46]

Built Environment. A variety of technological efforts are underway around the world to address vulnerabilities of coastal communities to sea-level rise. They include projects to erect barriers; increase land elevation; stabilize erodible shores; harden facilities; and to develop rigorous methodologies for assessing the costs, benefits, and broader implications of these engineered solutions. Notable examples include the Thames Estuary 2100 Project--which is looking for the best ways of protecting London from tidal flooding over the next century and beyond--and efforts in the Netherlands, Maldives, and Singapore for claiming or building up new land.[47] In the United States, under the CAP, Federal agencies are integrating climate and sea-level rise considerations into rebuilding and recovery efforts such as those being undertaken in the aftermath of Hurricane Sandy. In addition, cities like New York City are upgrading existing buildings to be resilient against storm surges, as part of comprehensive planning for adapting these key urban centers to expected climate change.[48]

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[43] Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being: Synthesis*. World Resources Institute, Washington, DC.

[44] Arkema et al. 2013. Coastal habitats shield people and property from sea-level rise and storms. *Nature Climate Change* 3: 913-918.

[45] *Climate Change Impacts in the United States*, 2014 [Third U.S. National Climate Assessment], p. 89.

[46] National Research Council, 2010. *America's Climate Choices: Adapting to the Impacts of Climate Change*, p. 209.

[47] Brown, S., et al., 2014. "Shifting Perspectives on Coastal Impacts and Adaptation," *Nature Climate Change* 4, 753-754.

[48] City of New York, 2013. PlaNYC: A Stronger, More Resilient New York, Chapter 4: Buildings.

Energy. The resilience of the electrical grid to weather and climate impacts may be increased by developing and implementing better grid sensors and equipment that enable adaptive switching of loads in cases of severe weather.[49] The adaptation of the electrical grid to climate change may also be improved by technologies that facilitate the deployment of "microgrids" to increase the resilience of the grid in specific areas.[50]

The Economics of Action and Inaction

The President's Climate Action Plan highlighted the sobering finding that changes in global climate that have been connected by science with increased emissions of greenhouse gases "come with far-reaching consequences and real economic costs." This June 2013 statement was based on the then-available subset of the peer-reviewed syntheses of the natural science of climate change and its impacts referenced in the first section of this testimony. The key question for economic analysis, bearing on decisions that are taken with respect to investments in climate-change mitigation and adaptation, is how the costs of these remedial actions compare to the costs of failing to take them (imposed by climate-change impacts that are not avoided by mitigation or ameliorated by improved preparedness and resilience).

Serious attempts to answer that question have been underway for some two decades. It is made particularly difficult by a number of factors, most notably: the uncertainties surrounding the exact character and magnitude of the climate-change impacts to be expected at global-average surface temperatures much higher than today's; the difficulty of monetizing many kinds of potential climate-change impacts—sea-level rise, ocean acidification, ecosystem disruptions, forced migration—even if they are reasonably well characterized; the uncertainties surrounding the future costs of many of the most promising technologies for reducing emissions from the global energy system; a baseline for energy-cost comparisons that is distorted by fossil-fuel subsidies and the free ride these fuels have enjoyed by being able to use the atmosphere as a waste dump for their green-house-gas emissions; and disagreements about the appropriate discount rates for reducing, to comparable present values, the costs of future remedial action and future climate-change impacts.

In the 1990s, attempts to compare the costs of action and inaction on climate change fell largely into two categories: studies arguing that, since the costs of taking action are relatively well defined and, at least initially, close in time, while the costs of inaction are highly uncertain and largely distant in time, it is reasonable to delay action; and studies arguing that the potentially catastrophic "downside" risks of extreme climate change were so terrible, even if decades or centuries away, that any prudent society would invest the relatively modest sums needed to significantly reduce those risks, as a form of "insurance".[51]

Since then, analyses attempting to quantify the costs of action and inaction have become more widespread and sophisticated, with the values obtained for both (under a variety of assumptions)

[49] Hoffman, P.A. 2014. "How Synchrophasors are Bringing the Grid into the 21st Century." http://energy.gov/articles/how-synchrophasors-are-bringing-grid-21st-century

[50] National Research Council, 2010. *America's Climate Choices: Adapting to the Impacts of Climate Change*, p. 74.

[51] See, e.g., W. D. Nordhaus, *Economic Journal*, vol 101, pp 920 ff, 1991; W. D. Nordhaus, *Managing the Global Commons: The Economics of the Greenhouse Effect*, MIT Press, 1994; G. Yohe, *Global Environmental Change*, vol 6, pp 87 ff, 1996.

tending to cluster in the range of 0.5 to 5 percent of global GDP in 2030, 2050, and 2100.[52] Despite this apparent symmetry, a growing consensus has emerged in recent years, among economists and others studying this matter, that the case for making substantial investments in climate-change mitigation and preparedness/resilience—and sooner rather than later—is compelling.[53]

There are several reasons for this:

1. The scientific evidence has been building that, as the global-average surface temperature gets to two degrees Celsius and more above the 1850-1900 level, the chances of truly unmanageable types and magnitudes of climate-change impacts becomes unacceptably high. (It is instructive that, the last time the Earth's temperature was that high was 130,000 years ago, and the height of sea that came to equilibrium with that temperature was between 5 and 10 meters higher than today.[54]) The possibility of these kinds of impacts has not been adequately taken into account in existing cost-of-inaction estimates, because nobody knows how to do it in a rigorous way, and the result is that the costs of inaction have been underestimated.
2. Even a few more years' delay in taking aggressive action to reduce the greenhouse-gas emissions of the major emitting nations will make it impossible to avoid exceeding the 2°C mark and extremely costly even to avoid exceeding 3°C. (Studies by the IPCC, the World Energy Conference, the U.S. National Academies, and others have shown that, from this point, delay in taking action makes any target in the 2-3°C range much more expensive to reach.[55])
3. Most past attempts to project future costs of environmental-control technologies have yielded numbers that turned out, in the course of time, to be overestimates because the use of market mechanisms allows for technology paths that minimize costs (e.g., acid rain program). There is a wide-spread suspicion that to the extent that market mechanisms are used, the same maybe true in the case of technologies to reduce emissions of greenhouse gases and black carbon.
4. Many of the most attractive measures for reducing emissions, as well as many of the measures being contemplated to increase preparedness for and resilience against the changes in climate that are not avoided, can carry very substantial co-benefits for public health (e.g.,

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[52] See, e.g., McKinsey and Company, *Pathways to a Low-Carbon Economy: Version 2 of the Global Greenhouse Gas Abate Cost Curve*, 2009; Intergovernmental Panel on Climate Change (IPCC) 2007; Edenhofer et al., *The Economics of Decarbonization*, Potsdam Institute for Climate Impact Research, 2009; and 2013-2014 IPCC Fourth and Fifth Assessments, reports of Working Group III, accessible at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

[53] See, e.g., Nicholas Stern (ed.), *The Economics of Climate Change: The Stern Review*, Cambridge University Press, 2007; Martin Weitzman, "On modeling and interpreting the economics of catastrophic climate change", *The Review of Economics and Statistics*, vol 91, no 1, pp 1-19; F. Ackerman et al., "The need for a fresh approach to climate-change economics", in *Assessing the Benefits of Avoided Climate Change: Cost-Benefit Analysis and Beyond*, 2010; Benjamin Crost and Christian Trager, "Optimal CO_2 mitigation under damage risk evaluation", *Nature Climate Change*, vol. 4, pp 631-636, 2014; Council of Economic Advisors, *The Cost of Delaying Action to Stem Climate Change*, Executive Office of the President of the United States, July 2014; M. R. Bloomberg, H. M. Paulson Jr., T. F. Steyer, *et al.*, *Risky Business: The Economic Risks of Climate Change in the United States*, June 2014, http://riskybusiness.org/uploads/files/RiskyBusiness_Report_WEB_09_08_14.pdf

[54] IPCC, *Climate Change 2013: The Physical Science Basis*, p. 46. No one is suggesting that sea levels in these ranges could be reached in this century, but Earth's history suggests that's where we're headed in the long run if we can't avoid going beyond 2°C and staying there.

[55] See for example IPCC AR5 Working Group 3 Summary for Policymakers Table SPM.2. See also IEA 2014, *op. cit.*, and Council of Economic Advisors, July 2014, *op cit.*

by reducing conventional air pollution) and for other societal values. These co-benefits have often not been included in the comparisons of the cost of action and cost of inaction that have been done, leading to an underestimate of the benefits of action.

Reflection of the foregoing in the CAP

President Obama has been committed, from the beginning of his Administration, to the rigorous use of the best available scientific and technical information in formulating policy, including, of course, policy to address the threats from climate change. It should not be surprising, then, that the bodies of scientific and technical knowledge and judgment summarized in the foregoing are robustly and appropriately reflected across all elements of the CAP and continue to underpin the CAP's implementation. Specifically:

- An up-to-date understanding of the natural science of anthropogenic climate change and its impacts on human well-being provides (a) the motivation for seeking to develop a cost-effective plan to reduce those impacts; (b) the sense of urgency for doing so at once rather than waiting; (c) the understanding that such a plan must include not only measures to reduce the emissions that are driving global climate change but also measures to increase prepared-ness for and resilience against the changes in climate that can no longer be avoided; (d) the detailed knowledge of the sources of the offending emissions and the character of society's vulnerabilities that allows appropriate specificity in designing a plan; and (e) the recognition that any U.S. plan must include a component designed to bring other countries along. These are the most basic underpinnings of the CAP.

- An up-to-date understanding of technological possibilities for mitigation and preparedness/ resilience reveals that there indeed exists a wide range of existing and developable options for cutting the carbon pollution that is driving climate change and for better preparing society to deal with the changes that materialize. The available technical insights about these options have enabled the CAP to focus specifically on enabling and incentivizing progress on the development and implementation of the most promising ones, both for emissions reductions and for building preparedness and resilience

- An up-to-date understanding of the results of economic assessments of the costs of taking actions of these sorts versus the costs of inaction provides the confidence that moving ahead now is the right thing to do and, more specifically, has provided the basis for the CAP's focus on those options that are most clearly cost-effective and that bring significant co-benefits. Because the CAP focuses only on the "low-hanging fruit" that is within reach without action by Congress, the costs of implementing it will be relatively low and, indeed, could well be completely repaid by the co-benefits (see below).

Some specifics of application of these insights in the CAP

With respect to actions that will lower emissions of heat-trapping carbon pollution, the CAP contains initiatives to make new energy technologies more economic by reducing barriers to their implementation (for example, through accelerated permitting of clean energy projects and streamlining for other Federal programs) and through regulatory actions for which there is an important role for the calculation of economic costs and benefits, especially with regard to implementation of specific parts of the CAP. For example, in the case of EPA's proposed rules to reduce carbon emissions from existing power plants, EPA's estimate of monetized benefits

and compliance costs shows that, in 2030, the combination of climate benefits and air-pollution health co-benefits from the proposed rule will total as much as $93 billion in constant dollars in 2030, while the annual compliance costs net of electricity consumption reduction is estimated to total $8.8 billion.

Other elements of the CAP are also being crafted in ways that generate monetized benefits that exceed any compliance costs. For example, the CAP calls for higher fuel economy standards for heavy-duty vehicles manufactured after model year 2018. This proposal is intended to follow on to a similar set of standards for heavy-duty vehicles for model years 2014 through 2018 that will result, by model year 2018, in a new semi-truck that will save its operator enough to pay for the technology upgrades in under a year and then realize net savings of $73,000 through reduced fuel costs over the truck's useful life.

The energy efficiency standards that are being encouraged under a new goal outlined in the CAP provide another example of how economic analysis is shaping the CAP's implementation. The underlying law governing these energy efficiency standards, the Energy Policy and Conservation Act of 1974, provides that any new or revised efficiency standard must be designed to achieve the maximum improvement in energy efficiency that is determined to be technologically feasible and economically justified. In order to be found to be economically justified, the benefits of the rule must outweigh its burdens. In carrying out this analysis, the DOE examines impacts on manufacturers; impacts on consumers; impacts on competition; impacts on utilities; national energy, economic and employment impacts; and impacts on the environment and energy security.

Regarding activities to prepare the United States for the impacts of climate change, the CAP outlines a series of measures that also have common-sense utility as well as significant economic benefits. They include efforts to encourage and support smarter, more resilient investments, including through agency grants, technical assistance, and other programs, in sectors from transportation and water management to conservation and disaster relief. In a year in which moderate to severe drought has covered a large area of the United States[56] continuously from the West Coast[57] to the Great[58] Plains[59], with two areas of extreme to exceptional drought in the California-Nevada[60] region and in the Southern Plains[61] centered in northern Texas, there are real economic benefits to helping communities to prepare for droughts and reduce drought impacts, as the Climate Action Plan does through its launch of a National Drought Resilience Partnership. In addition, Executive Order 13653 (issued under the CAP) has charged the Department of the Interior (DOI), the U.S. Department of Agriculture (USDA), NOAA, the EPA, the Federal Emergency Management Agency (FEMA), and the U.S. Army Corps of Engineers (USACE), among others, to identify additional opportunities for enhancing the resilience of the Nation's watersheds, natural resources, and ecosystems in the face of climate change through potential changes to their land- and water-related policies and programs. Agencies are building on efforts already completed or underway, as outlined in agencies' climate change adaptation plans, as well as recent interagency climate adaptation strategies, such as the National Action Plan: Priorities

[56] Source: NOAA: http://www1.ncdc.noaa.gov/pub/data/cmb/sotc/drought/2014/07/20140729_usdm.png
[57] Source: NOAA: http://www1.ncdc.noaa.gov/pub/data/cmb/sotc/drought/2014/07/20140729_west_trd.png
[58] Source: NOAA: http://www1.ncdc.noaa.gov/pub/data/cmb/sotc/drought/2014/07/20140729_high_plains_trd.png
[59] Source: NOAA: http://www1.ncdc.noaa.gov/pub/data/cmb/sotc/drought/2014/07/20140729_south_trd.png
[60] Source: NOAA: http://www1.ncdc.noaa.gov/pub/data/cmb/sotc/drought/2014/07/20140729_west_trd.png
[61] Source: NOAA: http://www1.ncdc.noaa.gov/pub/data/cmb/sotc/drought/2014/07/20140729_south_trd.png

for Managing Freshwater Resources in a Changing Climate; the National Fish, Wildlife, and Plants Climate Adaptation Strategy; and the resilience efforts outlined in the National Ocean Policy Implementation Plan. Collectively, these efforts will help to safeguard the nation's valuable natural resources in a changing climate.

Conclusion

In summary, the scientific and technological literature and analyses described herein make clear the case for urgent action against climate change and are clearly and pervasively reflected in the President's Climate Action Plan. Of course there is still more that could and should be done that would require the support of the Congress. I hope that this will be forthcoming.

I thank the Committee for its interest in this critically important issue. I will be pleased to take any questions Members may have at this time.

Attachment A

Recent Relevant Quotes from Authoritative Sources (inverse chronological order)

U.S. Global Change Research Program, Third U.S. National Climate Assessment, *Climate Change Impacts in the United States*, May 2014 http://nca2014.globalchange.gov

> *Long-term, independent records from weather stations, satellites, ocean buoys, tide gauges, and many other data sources all confirm that our nation, like the rest of the world, is warming. Precipitation patterns are changing, sea level is rising, the oceans are becoming more acidic, and the frequency and intensity of some extreme weather events are increasing. Many lines of independent evidence demonstrate that the rapid warming of the past half-century is due primarily to human activities.*
>
> *Human-induced climate change means much more than just hotter weather. Increases in ocean and freshwater temperatures, frost-free days, and heavy downpours have all been documented. Global sea level has risen, and there have been large reductions in snow-cover extent, glaciers, and sea ice. These changes and other climatic changes have affected and will continue to affect human health, water supply, agriculture, transportation, energy, coastal areas, and many other sectors of society, with increasingly adverse impacts on the American economy and quality of life.*

Intergovernmental Panel on Climate Change, Contribution of Working Group III to the IPCC Fifth Assessment: *Climate Change 2014: Mitigation: Summary for Policy Makers*, April 2014, http://www.ipcc.ch/

> *Without additional efforts to reduce GHG emissions beyond those in place today, emissions growth is expected to persist driven by growth in global population and economic activities. Baseline scenarios, those without additional mitigation, result in global mean surface temperature increases in 2100 from 3.7 to 4.8°C compared to pre-industrial levels (median values; the range is 2.5°C to 7.8°C when including climate uncertainty, see Table SPM.1).*

American Association for the Advancement of Science (the largest general scientific society in the world and the publisher of the prestigious journal, SCIENCE), *What We Know: The Reality, Risks, and Response to Climate Change*, March 2014
http://whatweknow.aaas.org/wp-content/uploads/2014/03/AAAS-What-We-Know.pdf

> *The overwhelming evidence of human-caused climate change documents both current impacts with significant costs and extraordinary future risks to society and natural systems. The scientific community has convened conferences, published reports, spoken out at forums and proclaimed, through statements by virtually every national scientific academy and relevant major scientific organization — including the AAAS—that climate change puts the well-being of people of all nations at risk.*

U.N. World Meteorological Organization, *WMO Statement on the Status of the Global Climate in 2013*, WMO, March 2014
https://docs.google.com/file/d/0BwdvoC9AeWjUeEV1cnZ6QURVaEE/edit?usp=sharing&pli=1

> *The year 2013 tied with 2007 as the sixth warmest since global records began in 1850. … Thirteen of the fourteen warmest years on record, including 2013, have all occurred in the twenty-first century. … While the rate at which surface air temperatures are rising has slowed in recent years, heat continues to be trapped in the Earth system, mostly as increased ocean heat content. About 93 per cent of the excess heat trapped in the Earth system between 1971 and 2010 was taken up by the ocean. From around 1980 to 2000, the ocean gained about 50 zettajoules (10^{21} joules) of heat. Between 2000 and 2013, it added about three times that amount.*

Intergovernmental Panel on Climate Change, Contribution of Working Group II to the IPCC Fifth Assessment: *Climate Change 2014: Impacts, Adaptation, and Vulnerability: Summary for Policy Makers*, March 2014, http://www.ipcc.ch/

> *Observed impacts of climate change are widespread and consequential. Recent changes in climate have caused impacts on natural and human systems on all continents and across the oceans.*

U.K. Royal Society and U.S. National Academy of Sciences (the two most prestigious science academies in the world), *Climate Change: Evidence and Causes*, February 27, 2014,
http://dels.nas.edu/resources/static-assets/exec-office-other/climate-change-full.pdf

> *Earth's lower atmosphere is becoming warmer and moister as a result of human-emitted greenhouse gases. This gives the potential for more energy for storms and certain severe weather events. Consistent with theoretical expectations, heavy rainfall and snowfall events (which increase the risk of flooding) and heat waves are generally becoming more frequent. … While changes in hurricane frequency remain uncertain, basic physical understanding and model results suggest that the strongest hurricanes (when they occur) are likely to become more intense and possibly larger in a warmer, moister atmosphere over the oceans. This is supported by available observational evidence in the North Atlantic.*

Intergovernmental Panel on Climate Change, Contribution of Working Group I to the IPCC Fifth Assessment: *Climate Science 2013: The Physical Science Basis: Summary for Policy Makers*, September 2013, http://www.ipcc.ch/

> *Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased. …It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.* [Emphasis in original. In IPCC terminology, "extremely likely" means the statement's probability of being correct is between 95 and 99 percent.]

Dr. Lonnie G. Thompson (Distinguished University Professor in the School of Earth Science at Ohio State University, winner of the National Medal of Science, member of the U.S. National Academy of Sciences, arguably the most distinguished glaciologist/paleoclimatologist in the

world), "Climate Change: The Evidence and Our Options", Byrd Polar Research Center Publication 1402, 2010 http://researchnews.osu.edu/archive/TBA--LTonly.pdf

> *Climatologists, like other scientists, tend to be a stolid group. We are not given to theatrical rantings about falling skies. Most of us are far more comfortable in our laboratories or gathering data in the field than we are giving interviews to journalists or speaking before Congressional committees. Why then are climatologists speaking out about the dangers of global warming? The answer is that virtually all of us are now convinced that global warming poses a clear and present danger to civilization.*

Dr. Robert McCormick Adams (former Secretary of the Smithsonian Institution) and 254 other members of the U.S. National Academy of Sciences, "Climate Change and the Integrity of Science", Letters to the Editor, SCIENCE, May 10, 2010
http://www.pacinst.org/wp-content/uploads/sites/21/2013/02/climate_statement3.pdf

> *There is compelling, comprehensive, and consistent objective evidence that humans are changing the climate in ways that threaten our societies and the ecosystems on which we depend. … Natural causes always play a role in changing Earth's climate, but are now being overwhelmed by human-induced changes.*

Dr. Alan Leshner (Executive Director of the American Association for the Advancement of Science) and the Presidents or Executive Directors of 17 other U.S. scientific societies (including the American Chemical Society, the American Geophysical Union, the American Meteorological Society, the American Statistical Association, and the Ecological Society of America), Open Letter to Members of the U.S. Senate, October 21, 2009
http://www.aaas.org/sites/default/files/migrate/uploads/1021climate_letter.pdf

> *Observations throughout the world make it clear that climate change is occurring, and rigorous scientific research demonstrates that the greenhouse gases emitted by human activities are the primary driver. These conclusions are based on multiple independent lines of evidence, and contrary assertions are inconsistent with an objective assessment of the vast body of peer-reviewed science. Moreover, there is strong evidence that ongoing climate change will have broad impacts on society, including the global economy, and on the environment. For the United States, climate change impacts include sea level rise for coastal states, greater threats of extreme weather events, and increased risk of regional water scarcity, urban heat waves, western wildfires, and the disturbance of biological systems throughout the country.*

Dr. Bruce Alberts (President of the U.S. National Academy of Sciences) and the presidents of all of the other national academies of science of the G8+5 countries (which include Russia, China, India, and Brazil), *G8+5 Academies Statement: Climate Change and the Transformation of Energy Technologies for a Low-Carbon Future*, May 2009
http://www.nasonline.org/about-nas/leadership/president/statement-climate-change.pdf

> *Climate change is happening even faster than previously estimated; global CO_2 emissions since 2000 have been higher than even the highest predictions, Arctic sea ice has been melting at rates much faster than predicted, and the rise in the sea level has become more rapid. Feedbacks in the climate system might lead to much more rapid climate changes. The need for urgent action to address climate change is now indisputable.*

Director John P. Holdren

Dr. John P. Holdren is Assistant to the President for Science and Technology, Director of the White House Office of Science and Technology Policy, and Co-Chair of the President's Council of Advisors on Science and Technology (PCAST). Prior to joining the Obama administration Dr. Holdren was Teresa and John Heinz Professor of Environmental Policy and Director of the Program on Science, Technology, and Public Policy at Harvard University's Kennedy School of Government, as well as professor in Harvard's Department of Earth and Planetary Sciences and Director of the independent, nonprofit Woods Hole Research Center. Previously he was on the faculty of the University of California, Berkeley, where he co-founded in 1973 and co-led until 1996 the interdisciplinary graduate-degree program in energy and resources. During the Clinton administration Dr. Holdren served as a member of PCAST through both terms and in that capacity chaired studies requested by President Clinton on preventing theft of nuclear materials, disposition of surplus weapon plutonium, the prospects of fusion energy, U.S. energy R&D strategy, and international cooperation on energy-technology innovation.

Dr. Holdren holds advanced degrees in aerospace engineering and theoretical plasma physics from MIT and Stanford. He is a member of the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences, as well as a foreign member of the Royal Society of London and former president of the American Association for the Advancement of Science. He served as a member of the MacArthur Foundation’s Board of Trustees from 1991 to 2005, as Chair of the National Academy of Sciences Committee on International Security and Arms Control from 1994 to 2005, and as Co-Chair of the independent, bipartisan National Commission on Energy Policy from 2002 to 2009. His awards include a MacArthur Foundation Prize Fellowship, the John Heinz Prize in Public Policy, the Tyler Prize for Environmental Achievement, and the Volvo Environment Prize. In December 1995 he gave the acceptance lecture for the Nobel Peace Prize on behalf of the Pugwash Conferences on Science and World Affairs, an international organization of scientists and public figures in which he held leadership positions from 1982 to 1997.

Opening Statement of Janet McCabe
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

Hearing on EPA's Proposed Clean Power Plan

Committee on Science, Space, and Technology
U.S. House of Representatives
September 17, 2014

Chairman Smith, Ranking Member Johnson, members of the Committee: Thank you for the opportunity to testify today.

Climate change is one of the greatest challenges of our time. It already threatens human health and welfare and economic well-being, and if left unchecked, it will have devastating impacts on the United States and the planet.

The science is clear. The risks are clear. And the high costs of climate inaction are clear. We must act. That's why President Obama laid out a Climate Action Plan and why on June 2 the Administrator signed the proposed Clean Power Plan—to cut carbon pollution, build a more resilient nation, and lead the world in our global climate fight.

Power plants are the largest source of carbon dioxide emissions in the United States, accounting for roughly one-third of all domestic greenhouse gas emissions.[1] While the United States has limits in place for the level of arsenic, mercury, sulfur dioxide, nitrogen oxides, and particle pollution that power plants can emit, there are currently no national limits on carbon pollution levels.

EPA's proposed Clean Power plan will cut hundreds of millions of tons of carbon pollution and hundreds of thousands of tons of other harmful air pollutants from existing power plants. Together these reductions will provide important health benefits to our most vulnerable citizens, including our children.

The proposed Clean Power Plan is a critical step forward. It is built on advice and information from states, cities, businesses, utilities, and thousands of people about the actions they are already taking to reduce carbon dioxide emissions.

The Plan aims to cut energy waste and leverage cleaner energy sources by doing two things: First, it uses a national framework to set achievable state-specific goals to cut carbon pollution per

[1] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012.

megawatt hour of electricity generated. And second, it empowers the states to chart their own, customized path to meet their goals.

We know that coal and natural gas play a significant role in a diverse national energy mix. This Plan does not change that—it builds on action already underway to modernize aging plants, increase efficiency, and lower pollution, and paves a more certain path for conventional fuels in a clean energy economy.

The EPA's stakeholder outreach and public engagement in preparation for this rulemaking was unprecedented. Starting last summer, we held eleven public listening sessions around the country. We participated in hundreds of meetings with a broad range of stakeholders across the country, and talked with every state.

Now, the second phase of our public engagement is underway. We've already held four public hearings in Atlanta, Denver, Pittsburgh, and Washington, DC, at which over 1300 people testified, we've had dozens of calls and meetings with states and other stakeholders, and we have already received hundreds of thousands of comments during our comment period that runs through October 16, 2014. Through meetings, phone calls, and other outreach, we are proactively seeking input, and many

states, utilities, and other stakeholders are bringing us suggestions that reflect the significant and thoughtful work they are putting into responding to this proposal.

These are just the sort of discussions we need to have. These are not mere words: this is a proposal, and we want and need input from the public.

To craft the proposed state goals, we looked at where states are today, and we followed where they're going. Each state is different, so each goal, and each path, can be different. The goals spring from smart and sensible opportunities that states and businesses are taking advantage of right now.

Under the proposal, the states have a flexible compliance path that allows them to design plans sensitive to *their* needs, including considering jobs and communities in a transitioning energy world. It also allows them enough time – fifteen years from when the rule is final until compliance with the final target – to consider and make the right investments, ensure reliability, and avoid "stranded assets."

Our plan doesn't just give states more options—it gives entrepreneurs and investors more options, too, by unleashing the market forces that drive innovation and investment in cleaner power and low-carbon technologies.

All told, in 2030 when states meet their goals, our proposal will result in about 30 percent less carbon pollution from the power sector across the U.S. when compared with 2005 levels – 730 million metric tons of carbon dioxide out of the air. In addition, we will cut pollution that causes smog and soot by more than 25 percent. The first year that these standards go into effect, we'll avoid up to 100,000 asthma attacks and 2,100 heart attacks—and those numbers increase over time.

In 2030, the Clean Power Plan will deliver climate and health benefits of up to $90 billion dollars. And for soot and smog reductions alone, that means for every dollar we invest in the plan, families will see $7 dollars in health benefits. And because energy efficiency is such a smart, cost-effective strategy, we predict that, in 2030, average electricity bills for American families will be 8 percent cheaper.

President Obama's Climate Action Plan provides a roadmap for federal action to meet the pressing challenge of a changing climate – promoting clean energy solutions that capitalize on American innovation and drive economic growth and providing a role for the full range of fuels, including coal and natural gas.

This proposal has started an active conversation about the steps that states, cities, utilities, and others are already taking to reduce their carbon pollution and about how the EPA can set targets and a reasonable schedule that can be achieved by every state, using measures they choose themselves to suit their own needs. The EPA looks forward to discussion of the proposal over the next several months, and I look forward to your questions. Thank you.

Janet McCabe, Acting Assistant Administrator for the Office of Air and Radiation

Janet McCabe is the Acting Assistant Administrator for the Office of Air and Radiation, having previously served as OAR's Principal Deputy to the Assistant Administrator.

Prior to joining EPA in November 2009, McCabe was Executive Director of Improving Kids' Environment, Inc., a children's environmental health advocacy organization based in Indianapolis, Indiana and was an adjunct faculty member at the Indiana University School of Medicine, Department of Public Health.
From 1993 to 2005, Ms. McCabe held several leadership positions in the Indiana Department of Environmental Management's Office of Air Quality and was the office's Assistant Commissioner from 1998 to 2005. Before coming to Indiana in 1993, Ms. McCabe served as Assistant Attorney General for environmental protection for the Commonwealth of Massachusetts and Assistant Secretary for Environmental Impact Review.

Ms. McCabe grew up in Washington, D.C. and graduated from Harvard College in 1980 and Harvard Law School in 1983.

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THE ADMINISTRATION'S CLIMATE PLAN: FAILURE BY DESIGN

Wednesday, September 17, 2014

House of Representatives,

Committee on Science, Space, and Technology

Washington, D.C.

The Committee met, pursuant to call, at 10:04 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Lamar Smith [Chairman of the Committee] presiding.

Chairman SMITH. The Committee on Science, Space, and Technology will come to order. Welcome to today's hearing titled ''The Administration's Climate Plan: Failure by Design.'' I am going to recognize myself for an opening statement and then the ranking member.

Today we look at one of the most aggressive new government programs in our country's history. The Obama Administration calls it the Climate Action Plan. It empowers the Departments of Interior, Energy, Agriculture, Defense, Transportation, Housing and Urban Development, Health and Human Services, National Institute of Standards and Technologies, NOAA, FEMA, the U.S. Army Corps of Engineers, and the EPA to implement broad climate policies and programs with great cost and little benefit to the American people.

The cornerstone of the White House sweeping Climate Action Plan is EPA's power plant regulation. Extending well beyond the power plants themselves, this rule will increase the cost of electricity and the cost of doing business. It will make it harder for the American people to make ends meet. In fact, EPA's own data shows us that its power plant regulation would eliminate less than 1 percent of global carbon emissions. Analysis shows this would reduce sea-level rise by the thickness of a mere three sheets of paper, at best. EPA's mandates will be difficult for states to meet even under ideal circumstances. If energy prices or energy

demand escalate, the costs of meeting those mandates will soar and American families will be forced to pay the bill.

Charles McConnell, a former Assistant Secretary for Energy appointed by President Obama, has taken the Administration to task for creating a plan doomed to fail. In a recent op-ed, Mr. McConnell asks, ''Have we lost our minds? Has this administration convinced itself that it can mandate something that is fundamentally useless? Does the EPA think the American public and global community are not capable of seeing the illusion for what it is?''

What is clear is that by eliminating affordable, reliable power options, the regulation will increase the energy prices for the majority of Americans. That means everything will cost more, from electricity to gasoline to food. Higher costs will drive companies out of business, kill good jobs, and leave even more Americans unemployed.

Until this Administration can propose a detailed strategy, tell us the total cost, and show us exactly what we will get for the sacrifice, we are just asking the American people to waste their money. America cannot afford to drive its economy over a cliff with the hopes that the rest of the world will make the same mistake. The only economy the EPA's plan will help is that of our competitors.

[The statement of Mr. Smith follows:]

61 ********** INSERT 1 **********

Chairman SMITH. And that concludes my opening statement. The ranking member, the gentlewoman from Texas, Ms. Johnson, is recognized for hers.

Ms. JOHNSON. Thank you very much, Mr. Chairman, and good morning to all.

I would like to extend a warm welcome to our witnesses, Dr. Holdren and Ms. McCabe, and thank you both for being here this morning. It is nice to see you again, and I appreciate you taking the time to appear before us today.

This morning we are going to discuss the President's Climate Action Plan and a part of that plan, a proposal by the Environmental Protection Agency to cut carbon emissions from the largest source of those emissions: power plants.

I would like to begin by noting the title given to this morning's hearing by my Republican colleagues, ''The Administration's Climate Plan: Failure by Design.'' ''Failure by design'' is an ironic choice of words considering my colleagues' preferred alternative appears to be doing nothing and hiding our collective heads in the sand. We all know that such inaction will not solve anything, and it doesn't--it certainly won't stop the Earth from warming, and in my opinion, the Majority's ''do nothing'' plan is a real example of failure by design.

I also know that some still question whether climate change is real, but surely we are now beyond debating that

question. Reports based on the work of the world's top scientists such as the U.S. National Climate Assessment and those from the U.N. Intergovernmental Panel on Climate Change have sent a stark message to our Nation's leaders and the international community, namely, the adverse effects of climate change are evident today and require immediate action or these adverse effects will grow dramatically worse.

To be fair, in trying to understand a phenomenon of this magnitude, the job of science will never be done. It will continue to evolve. We must always keep looking for new answers, replacing opinions with data, and projections with observations. We must continue to innovate in how we predict, measure, prevent, and adapt to climate change. That is the nature of science and of our stewardship of the planet.

However, we in Congress have to acknowledge that we are not the experts and that allowing partisan politics to distort scientific understanding of climate change is cynical and shortsighted. We may not agree on where the uncertainties within climate science lie but we should all be able to understand that vast and avoidable uncertainties will remain if we stop the progress of climate research.

Experts from industry, academia, and every level of government are calling on us to help prepare our communities for the threats they face due to climate change. We must

answer their call and act.

Cutting carbon emissions from the power sector is critical to any effort to address climate change, and that is why I am supportive of the EPA's Clean Power Plan. EPA's proposal, like the rest of the President's Climate Action Plan, is a bold step forward our Nation needs. It gives states the flexibility to develop innovative policies that cater to regional differences. It is based on strategies already in use such as improving energy efficiency and encouraging the development of renewables.

Let us be clear: EPA is not imposing a specific set of measures. States will choose what goes into their plans and they can work alone or as part of a multi-state effort to achieve meaningful reductions. These are commonsense steps that will lead to a healthier environment, because acting on climate change is not only an environmental imperative, but a public health and economic one as well.

Among the many health concerns, greater risk of asthma attacks, heat stroke, and respiratory disease are all consequences of a warming climate. Likewise, energy demand, agricultural production, labor productivity, and the risks to coastal properties are just a few of the economic areas where climate change has already taken, and will continue to take, its toll.

We as a Nation must act today to address climate change

if we are to preserve our quality of life for our children and grandchildren. The negative consequences of climate change are not abstract scientific predictions for the far-off future. We are facing some of these consequences now and they are affecting every American.

I look forward to working with this Administration as it puts forward policies like the Clean Power Plan and the Climate Action Plan, which will ensure a vibrant future economy and a safe and healthy environment.

Thank you, Mr. Chairman, and before and I yield back, I want to share that there is an article from ThinkProgress.org that I would like to submit to the record. While some in Congress still refuse to admit that climate change is even happening, there is evidence here where this article describes how eight major companies have accepted the reality of climate change and are prepared to address the threats posed to their products and financial interests: Chipotle, Green Mountain, Michael Foods, Big Hard Pit brands, Omega Protein, Marine Harvest ASA, and most notably, Heinz and Coca-Cola. To quote the beverage titan: ''Changing weather patterns along with the increase frequency or duration of extreme weather conditions could impact the availability or increase the cost of key raw materials that the company uses to produce its products. In addition, the sales of these products can be impacted by weather conditions.''

I ask unanimous consent that this article be included in the record.

[The statement of Ms. Johnson follows:]

********** INSERT 2 **********

Chairman SMITH. Thank you, Ms. Johnson, and without objection, those materials will be a part of the record, though I think you have just succeeding in reading almost all of it into the record already.

Ms. JOHNSON. That is okay.

Chairman SMITH. We will get a double dip on that.

[The information follows:]

********** INSERT 5 **********

Chairman SMITH. I will now proceed to introduce our witnesses, and we do appreciate their being here today.

Our first witness is the Honorable John Holdren. Dr. Holdren serves as the Director of the Office of Science and Technology Policy at the White House, where he is both the Assistant to the President for Science and Technology and Co-Chair of the President's Council of Advisors on Science and Technology called PCAST. Prior to his current appointment by President Obama, Dr. Holdren was a Professor in both the Kennedy School of Government and the Department of Earth Science at Harvard. Before that, he was a member of the faculty at the University of California Berkeley, where he found and led a graduate degree program in energy and resources. Dr. Holdren graduated from MIT with degrees in aerospace engineering and theoretical plasma physics.

Our second witness is Ms. Janet McCabe, Acting Assistant Administrator for the Office of Air and Radiation at the Environmental Protection Agency. Previously, she was the Office of Air and Radiation's Principal Deputy to the Assistant Administrator. Prior to joining the EPA, Ms. McCabe was the Executive Director of Improving Kids' Environment Inc., a children's environmental health advocacy organization. She also previously served in several leadership positions in the Indiana Department of Environmental Management's Office of Air Quality. Ms. McCabe

received both her undergraduate degree and law degree from Harvard.

Again, we thank you for being here today, and Dr. Holdren, we will begin with you.

STATEMENTS OF HON. JOHN HOLDREN, DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT; AND JANET MCCABE, ACTING ASSISTANT ADMINISTRATOR, OFFICE OF AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY

STATEMENT OF JOHN HOLDREN

Mr. HOLDREN. Thank you very much, Chairman Smith, Ranking Member Johnson, members of the Committee. I am genuinely pleased to be here today to discuss the ways that the Federal Government has incorporated and continues to incorporate scientific information from the most authoritative sources into the formulation and implementation of all three components of President Obama's Climate Action Plan, cutting carbon pollution in America, preparing the United States for the impacts of climate change and leading international efforts to address the global climate change challenge.

Given the thrust of my testimony and noting Ranking Member Johnson's comments on the title of the hearing, I would like to propose respectfully an alternative one: The Administration's Climate Plan: Success through Science.

That plan rests primarily on scientific and technological understandings in three categories: first, the natural science of anthropogenic climate change and its

impacts on human well-being; second, technological analysis of the options for climate change mitigation and for increasing preparedness for and resilience against the changes in climate that mitigation fails to avoid; and third, the economics associated with estimating both the costs of action and the costs of inaction on the climate change challenge.

There is an immense amount of peer-reviewed research in all three categories. An assessment summarizing the state of knowledge in all three have been carried out by a wide variety of respected national and international bodies. Examples include the reviews by the U.S. National Academies and the Intergovernmental Panel on Climate Change, the second and third U.S. National Climate Assessments, the annual State of the Climate reports of NOAA, the periodic assessment reports of the U.S. Global Change Research Program, and the first Quadrennial Energy Technology Review of the U.S. Department of Energy. These assessments and many more were drawn up in the interagency effort led by the Executive Office of the President, which developed the elements of the Climate Action Plan for the President's consideration.

A particularly accessible digest of the relevant state of knowledge as of early 2013 and a set of recommendations based on that knowledge was provided to the President and the interagency group in March of that year by the President's

Council of Advisors on Science and Technology. That report's influence on the Climate Action Plan was considerable.

My written statement discusses in some detail those conclusions from the indicated scientific assessments that were and are most germane to the formulation of the Climate Action Plan and to its implementation. Given President Obama's Commitment from the beginning of his Administration to the rigorous use of the best available scientific and technical information in formulating policy, it should not be surprising that the scientific conclusions summarized in my written statement are reflected across all elements of the Climate Action Plan and continue to underpin its implementation.

Specifically, an up-to-date understanding of the natural science of anthropogenic climate change and its impacts on human well-being provides first, the motivation for seeking to develop a cost-effective plan to reduce those impacts; second, the sense of urgency for doing so at once rather than waiting; third, the understanding that such a plan must include not only measures to reduce the emission that are driving global climate change but also measures to increase preparedness for and resilience against the climate changes that can no longer be avoided; fourth, the detailed knowledge of the sources of the offending emission and the character of society's vulnerabilities that allows appropriate specificity

in designing a plan; and fifth, the recognition that any U.S. plan must include a component designed to bring other countries along. These are the most basic underpinnings of the Climate Action Plan.

Further, an up-to-date understanding of technological possibilities for both mitigation and preparedness and resilience reveals that there indeed exists a wide range of options for cutting the carbon pollution that is driving climate change and for better preparing society to deal with the changes that materialize. The available technical insights about these options have enabled the Climate Action Plan to focus specifically on enabling and incentivizing progress on the implementation and, where necessary, the further development of the most promising options.

Finally, an up-to-date understanding of the results of economic assessments of the cost of taking actions of these kinds versus the cost of inaction provides the confidence that moving ahead now is the right thing to do, and more specifically, has provided the basis for the Climate Action Plan's focus on those options that are most clearly cost-effective and that bring significant co-benefits.

Because the Climate Action Plan focuses only on the low-hanging fruit that is within reach without action by Congress, the costs of implementing it will be relatively low and indeed might well be completely repaid by the

co-benefits.

Of course, there is still more that could and should be done beyond the Climate Action Plan that would require the support of the Congress. I hope that that support will be forthcoming.

I thank the Committee for its interest in this critically important issue, and I will be pleased to take any questions the members may have. Thank you.

[The statement of Mr. Holdren follows:]

********** INSERT 3 **********

Chairman SMITH. Thank you, Dr. Holdren.

Ms. McCabe.

STATEMENT OF JANET MCCABE

Ms. MCCABE. Thank you, Chairman Smith, good morning, and Ranking Member Johnson and members of the Committee. Thank you for the opportunity to testify today. I am very pleased to be here with Dr. Holdren.

The science is clear, the risks are clear, and the high costs of climate inaction are clear. We must act. That is why President Obama laid out a Climate Action Plan and why on June 2nd of this year, Administrator McCarthy signed the proposed Clean Power Plan to cut carbon pollution, build a more resilient Nation, and lead the world in our global climate fight.

Power plants are the largest source of carbon dioxide emission in the United States. While the United States has limits in place for the level of arsenic, mercury, sulfur dioxide, nitrogen oxide and particle pollution that power plants can emit, there are currently--

Chairman SMITH. There we go. Well, we are getting there. There we go.

Ms. McCabe, if you will proceed? I hope that this is fixed permanently. Thank you.

Ms. MCCABE. American know-how at work.

As I was saying, while the United States currently has standards in place for a range of harmful pollutants that are emitted by power plants, there are currently no national limits on carbon pollution from these sources.

The Power Plan aims to cut energy waste and leverage cleaner energy sources by doing two things. First, it uses a national framework to set achievable state-specific goals to cut carbon pollution per megawatt-hour of electricity generated. Second, it empowers the states to chart their own customized path to meeting their goals.

We know that coal and natural gas play a significant role in a diverse national energy mix. This plan does not change that. It builds on actions already underway to modernize aging plants, increase efficiency and lower pollution, and it paves a more certain path for conventional fuels in a clean energy economy.

The EPA stakeholder outreach and public engagement in preparation for this rulemaking was and continues to be unprecedented. Starting last summer, we held 11 public listening sessions around the country. We participated in hundreds of meetings with a broad range of stakeholders across the country and talked with every state. Now the second phase of our public engagement is underway. We have already held four public hearings in Atlanta, Denver,

Pittsburgh and Washington, D.C., at which over 1,300 people testified. We have had hundreds of calls and meetings with states and other stakeholders, and we have already received more than three-quarters of a million comments. Through meetings, phone calls and other outreach, we are proactively seeking input, and many states, utilities and other stakeholders are bringing us suggestions that reflect the significant and thoughtful work they are putting into responding to this proposal. Because of this strong interest, in fact, we announced yesterday that we are extending the comment period for an additional 45 days to December 1st.

These are just the sort of discussions we need to have, and these are not mere words: this is a proposal we want and need input from the public.

To craft the proposed state goals, we looked at where states are today, and we followed where they are going. Each state is different, so each goal, and each path, can be different. The goals spring from smart and sensible opportunities that states and businesses are taking advantage of right now.

Under the proposal, the states have a flexible compliance path that allows them to design plans sensitive to their needs, including considering jobs and communities in a transitioning energy world. It allows them enough time--15

years from when the rule is final until compliance with the final target--to consider and make the right investments, ensure reliability, and avoid stranded assets.

All told, in 2030 when states meet their goals, our proposal will result in about 30 percent less carbon pollution from the power sector across the United States when compared with 2005 levels. In addition, we will cut pollution that causes smog and soot by more than 25 percent. Together, these reductions will provide important health benefits to our most vulnerable citizens including our children.

In 2030, the Clean Power Plan will deliver climate and health benefits of up to $90 billion, and because energy efficiency is a cost-effective strategy, we predict that in 2030, average electricity bills for American families will be 8 percent cheaper.

This proposal has started an active conversation about the steps that states, cities, utilities and others are already taking to reduce carbon pollution and how about the EPA can set targets and a reasonable schedule that can be achieved by every state, using measures they choose themselves to suit their own needs.

The EPA looks forward to discussion of the proposal over the next several months, and I look forward to your questions. Thank you.

[The statement of Ms. McCabe follows:]

********** INSERT 4 **********

Chairman SMITH. Thank you, Ms. McCabe.

The gentleman from Indiana, the chairman of the Research and Technology Subcommittee, has a markup in another Committee and has to leave immediately, so I am going to recognize himself for questions and then I will take his place when it is time for him to ask questions.

Mr. Bucshon.

Mr. BUCSHON. Thank you, Mr. Chairman.

Over the last few years we have gone from global warming to now climate change since the temperature of the Earth hasn't changed in many, many years. The temperature of the Earth has been changing for centuries. I fully believe that the temperature of the Earth is changing. But of course, now supporters of this new regulation are saying well, it is changing now at an unusual pace compared to the past because now the American public is getting it that the temperature of the Earth has been changing for centuries.

Ms. McCabe, first of all, welcome from Indiana. This plan places a heavy burden on the states. Many state legislatures will need to approve enabling statutes to implement the rule. For example, we have heard from previous witnesses that have come before this Committee that states will need to devise institutional arrangements between state public utility commissions and state environmental regulators to implement carbon-driven resource planning. Further,

states will need to consider legislation to implement energy efficiency measures to meet the goals under the plan and to grant additional authorities to state public utility commissions on such matters as stranded investment and cost allocation.

It is quite possible that certain states, for whatever reason, will be unable to make these steps in which case the state plans will be inadequate under the proposal, thus mandating the EPA-issued Federal Implementation Plan, or FIP.

Can you describe for me what an FIP would look like where a state has failed to enact the necessary laws to carryout EPA's plan for them? For example, what would an EPA-imposed energy efficiency mandate look like and how would EPA allocate costs under such a mandate?

Ms. MCCABE. Congressman, thank you for your question. Let me first emphasize that in the plan, the proposal, we certainly recognize that there are steps that states will need to take in order to put authorities in place and design their plans, and we provided several years for that work to take place, assuming that States will be going forward with that. Many states already have programs in place that they will be able to use or build upon, and we are confident that working with the states, as EPA always has in implementing Clean Air Act programs, that we will be/able to find time and work with each other to make sure that states have the time

they need to put authorities in place, and that is what we are focused on at the moment is making sure that we understand one another, that we hear from the states about the timing challenges that they expect to have and the things that they need to do, and we are confident that we will be able to move forward with states in a productive way so that they can be successful in developing and implementing their own plans.

Mr. BUCSHON. Thank you. Is it true that this rule has no effect on the global temperature change?

Ms. MCCABE. This rule is about cutting carbon pollution, and cutting carbon pollution will help address the contributions to the effects that we are seeing--

Mr. BUCSHON. Because we have had--we have heard Administrator--previous Administrators from the EPA say that it won't. It is not about affecting the global temperature and climate change.

Ms. MCCABE. Well, I can--

Mr. HOLDEN. Can I take that?

Ms. MCCABE. Sure.

Mr. HOLDEN. Yeah, I would like to respond to that if I may.

Mr. BUCSHON. Yeah. I mean, there are public comments out there that that question has been asked and answered saying no.

Mr. HOLDREN. You should look at the scientific literature rather than the public comments. The fact is--

Mr. BUCSHON. Of all the climatologists whose career depends on the climate changing to keep themselves publishing articles, yes, I could read that but I don't believe it.

Mr. HOLDREN. If you would allow me to finish, the point is that the limitation on carbon emissions in the United States is a very important first step for us to take on a longer trajectory to meet the President's goals of a 17 percent reduction from 2005 by 2020, and ultimately an 80-plus percent reduction by 2050. If the United States does not take that sort of action, it is unlikely that other major emitters in the world--China, India, Russia, Europe, Japan--will do so either, and the fact is, all of us need to reduce our carbon emission if we are to avoid unmanageable degrees of climate change.

Mr. BUCSHON. Okay. Fair enough.

Ms. McCabe, there is some--I mean, maybe it is--there is some comments out there saying, you know, asthma attacks decrease, heart attacks decrease. Where do you get that information? Because I was a medical doctor before, and it says in the first year the plan will avoid 100,000 asthma attacks and 2,100 heart attacks. I can tell you, as a medical doctor, you cannot say that.

Ms. MCCABE. Well--

Mr. BUCSHON. That is just scare tactics. That is not factual.

Ms. MCCABE. Well, all of our information is based on factual information that is developed and in the record and available for people to comment on.

Mr. BUCSHON. And let me say I reviewed that from the American Lung Association. In fact, their medical director came down last year from New York and spoke to me about this. And it is based--is it true or not that it is based on actually modeling and not actually factual patient data?

Ms. MCCABE. There is a large body of evidence that--

Mr. BUCSHON. Is it based on computer modeling or is it based on factual medical data? That is the question. Yes or no.

Ms. MCCABE. EPA uses both modeling and--

Mr. BUCSHON. And is it true that the model that was created to do this, the EPA paid tens of thousands of dollars to the person to create the model to, in my view, after I have looked at all the science including people who funded the research--the funders of this research that was done are all pretty far left global warming foundations and others that want this data to come out? I mean, I am just saying, it all depends. If you are a medical person and you look at who funds a study and the result of the study, I mean, I look at the first, who funded it, and if people that believe the

result funded it, do you see where I am getting at?

Ms. MCCABE. Yes, Congressman--

Mr. BUCSHON. And it is all based on modeling, not on factual information, so I would--I just--

Mr. HOLDREN. Can I take a piece of this as well?

Mr. BUCSHON. No, I am over my time so what I want--I will just say this and I yield back to the chairman, that scare tactics like that, you know, is really appalling to me to use medical information to scare parents that their children about asthma attacks and scare people saying they are going to have heart attacks and you are going to prevent that with this rule in the first year. That is just not factual. And I would argue that we should all on both sides of this discussion avoid scare tactics.

I yield back, Mr. Chairman.

Chairman SMITH. Thank you, Dr. Bucshon. The gentlewoman from Oregon, Ms. Bonamici, is recognized.

Ms. BONAMICI. Thank you very much, Mr. Chairman. Thank you to both of our witnesses for appearing before us again to discuss this very important topic, and I am glad that my colleague, Mr. Bucshon, mentioned scare tactics because, Mr. Chairman, I have an article that I would like to submit for the record because we are likely to hear some arguments that the coal industry has used over the years to sway people against regulation designed to protect the environment, and

so I would like to introduce this article, which chronicles the coal industry's overreactions and some exaggerated claims over the last 40 years.

Chairman SMITH. Without objection, the article will be a part of the record.

[The information follows:]

********** INSERT 6 **********

Ms. BONAMICI. Thank you. I hope the Committee members read this article as well.

Thank you again. I am going to begin my question in this hearing much the same way as I began when we held a similar hearing just over a month ago by briefly discussing the economic costs of failing to act to combat climate change for communities. For example, in my district in Oregon, the threat of climate change brings serious economic consequences to coastal communities with the fishing and seafood industries, for example, rely on a healthy ocean to support their livelihood. The agriculture sectors need freedom from concerns about drought. Changes in our climate brought on by record-high carbon emission causes economic concern. Many Fortune 500 companies are now building the economic realities of climate change into their long-term business plans. Insurance companies are starting to account for the increased frequency of severe weather events. These things are happening, and it is up to us as policymakers to act now to mitigate the damage.

So Dr. Holdren, first of all, thank you for your very thorough testimony. I do encourage members of the Committee to read your entire written testimony, which is very thorough and detailed. We are here today to ostensibly discuss the science behind the EPA regulations, and because some people question whether the EPA is considering the economic impact

of its regulations, can you please expand on the potential economic benefits of reducing greenhouse gas emissions through rules like the recently proposed rule limiting emissions from existing power plants?

Mr. HOLDREN. Thank you. I am happy to do that. There is some considerable discussion of that in my rather lengthy written statement, but the fact is that we are facing under unabated continuation of global climate change large increases in damages from a wide variety of extreme weather events including, in some regions, floods, in other regions, droughts, in many regions, more extreme heat waves, in many regions, more wildfires, pest outbreaks, pathogen spread in terms of geographic range. We are looking at impacts on many sectors of the economy on the energy sector, the forestry sector, the agriculture sector, the fishery sector. We are looking at increases in ocean acidification that have the potential to dramatically change ocean food chains and fisheries possibilities, and we are looking, as already mentioned, at human health effects, and I would mention, although Dr. Bucshon has now left, that the models that are used in this domain are all based on data. They are based on patient data. They are based on epidemiological studies, and there is a wide range of models, not a single model. They have been funded by a wide range of sources, and the findings in the National Climate Assessment, which came out in May, on

the impacts of climate change on health were thoroughly vetted by experts at the National Institutes of Health--

Ms. BONAMICI. Thank you, Doctor. I do want to have time for one quick question.

Mr. HOLDREN. Sorry.

Ms. BONAMICI. But thank you for that clarification.

On a related note, I want to follow up on something that was discussed in our July hearing. Dr. Cash from the Massachusetts Department of Environmental Protection stated that EPA's latest action will ''help the Nation develop an advanced energy infrastructure.'' So can you please both comment briefly on the importance of having the United States lead the way in the development and implementation of the next generation of energy policies and talk about whether the existence of rules will foster innovation by creating demand for new technologies.

Ms. MCCABE. I will take a start at it. This is another example of how regulations will spur innovation and development of new technologies. In particular, what we found when we looked at what the power sector and States were already doing to address carbon is that they were investing in renewable energy and moving that forward. They were investing in energy efficiency and moving that forward, and there is huge opportunities in addition to other sorts of technologies for this plan to spur even greater investment in

those sorts of technologies and move them into all across the country and into the mainstream.

Ms. BONAMICI. And I trust you would both agree with me that we would prefer that the United States be the leader in developing these technologies.

Ms. BONAMICI. Absolutely.

Mr. HOLDREN. I would just add and emphasize that countries all around the world are buying renewable-energy technologies, they are buying energy-efficiency technologies, they are buying cleaner fossil-fuel technologies. They are going to be buying a lot more of them because it is recognized all around the world that climate change is real and we need to do something about it, and we will be far better off if the United States is the principal provider of those technologies in the decades ahead than if we allow other countries to take the lead in that domain.

Ms. BONAMICI. Thank you. My time is expired. I yield back. Thank you, Mr. Chairman.

Chairman SMITH. Thank you, Ms. Bonamici.

The gentleman from California, Mr. Rohrabacher, is recognized for his questions.

Mr. ROHRABACHER. Thank you very much, and thank you for being with us today.

I--let me just note about the last point, yeah, we do have countries like Spain investing in other types of

technology for producing energy and it is breaking their bank. It is putting them into bankruptcy.

We have--there is just a list of things that just--note that this is a matter of contention that I would think the public should look at, whether or not there actually has been 17 years where there has been no warming, although that was what was predicted. We have--I keep seeing reports saying that they--that there are no more hurricanes than there always have been or they are not more extreme than they ever were.

We have climate models obviously that have been presented us that we were going to have a huge jump in our temperature that were clearly wrong. The Arctic ice volume now is increasing rather than decreasing, as is the population of the polar bears increasing rather than decreasing, and we have seen an increase in plant growth and crop yields. Let me--so those are just matters.

Back-and-forth we--those people who believe that humankind is a--and our activities are changing the climate and those of us who don't, we need to know whether those specific issues--what the facts show on those things because I keep hearing disagreement from those who would like to pass regulations like the ones we are talking about today.

Ms. McCabe, at what point--you keep using the word carbon pollution--

Ms. MCCABE. Um-hum.

Mr. ROHRABACHER. --at what point--level of CO2 does CO2 become damaging to human health?

Ms. MCCABE. Well, carbon--

Mr. ROHRABACHER. Right now, we have CO2 at about 400 parts per million.

Ms. MCCABE. Um-hum.

Mr. ROHRABACHER. At what point does that actually become harmful to human beings?

Ms. MCCABE. I will let Dr. Holdren amplify my answer, but it is clear that the amount of carbon that is being emitted--

Mr. ROHRABACHER. No, no, I am asking for a specific number. You guys are the experts. You are passing--you are here telling us to pass what we consider to be a draconian regulation. You should know at what point it becomes harmful to human health. If it is now at 400 parts per million--Dr. Holdren, maybe you have the answer to that--at what level does it become harmful to human beings?

Mr. HOLDREN. Vice Chairman Rohrabacher, I always enjoy my interactions with you. I have to say, with respect, that is a red herring. We are not interested in carbon dioxide concentrations because of their direct effect on human health. We are interested in them because their effect--of their affect--

Mr. ROHRABACHER. All right.

Mr. HOLDREN. --on the world's climate, and climate change has effects--

Mr. ROHRABACHER. So it is a red herring--

Mr. HOLDREN. --on human health.

Mr. ROHRABACHER. Okay. So it is a red herring to say that when people are talking about human health that the actual--there is no direct impact on human health, that this is something--

Mr. HOLDREN. Not of CO2 concentration. There is a direct--

Mr. ROHRABACHER. All right. All right.

Mr. HOLDREN. --there are very strong and direct impacts--

Mr. ROHRABACHER. Okay.

Mr. HOLDREN. --and there is a strong direct effect--

Mr. ROHRABACHER. Strong indirect, okay.

Mr. HOLDREN. --and there is a strong direct effect--

Mr. ROHRABACHER. So let's go--

Mr. HOLDREN. --on the co-emitted pollutants--

Mr. ROHRABACHER. So let's go for the record--

Mr. HOLDREN. --like oxides or sulfur--

Mr. ROHRABACHER. So let's go for the record that you have now agreed there is no direct impact on human health by CO2 concentration--

Mr. HOLDREN. And a huge indirect impact.

Mr. ROHRABACHER. And at what time--I guess we will say you are not even going to go--because the next level higher is going to go to us--how long will it take us to get to the point where it does actually impact human health?

And I will just put in for the record that it seems--it is at 400 parts per million now and between 1,000 to 2,000 parts is what we pump into greenhouses and it is commonly accepted that it takes about 20,000 parts per million as differentiated from the 400 parts per million now that we have before it becomes harmful to human health, unless of course you want to say that those things that we just--that I just outlined are real, that there has actually been warming, that the models have been successful, that the Arctic ice now is not growing now, and the population of the polar bears is continuing to diminish, and et cetera, et cetera. So, yeah--

Mr. HOLDREN. May I respond?

Mr. ROHRABACHER. You certainly may.

Mr. HOLDREN. First of all, there is a long section in my testimony explaining that the so-called hiatus in global warming is not what you have portrayed it to be. It is a slowdown in the rate of increase of the atmospheric surface temperature from what occurred in previous decades. The fact is, even by that index, the Earth is still warming. The 2000s were warmer than the '90s, the 2010s so far have been

warmer than the 2000s, 13 of the 14 hottest years in the instrumental record going back 150 years--

Mr. ROHRABACHER. Right.

Mr. HOLDREN. --have occurred since 2000.

Mr. ROHRABACHER. Okay. And let's--

Mr. HOLDREN. And it is also true--

Mr. ROHRABACHER. Okay.

Mr. HOLDREN. --that in terms of the Arctic ice in volume and an area at any given time of year it continues to be on a shrinking trajectory, although of course there is natural variability that bounces it up and down a bit--

Mr. ROHRABACHER. But you--

Mr. HOLDREN. --but the trend is unmistakable.

Mr. ROHRABACHER. But you will acknowledge that there are many scientists--and by the way, I want to congratulate both of you because last time you were both here independently when we tried to pin down this fraud of 97 percent of all the scientists agree that manmade global warming is now upon us, you both refused to back up that fraudulent claim and I applaud you for that.

Let me just note that the--when we are talking about these issues--the very issues that we brought up, there are legitimate scientists--this isn't just a claim here at the hearing--there are legitimate scientists on both of these issues, on both sides of the various issues that you and I

just brought up, and I think that it behooves us not to just suggest that, well, this is what the fact is.

I think that what we should all do is compare the various scientific facts that are coming in and not just dismiss all of the scientists who are claiming that no, the polar bears are not disappearing and no, there are not more hurricanes, there are not more tornadoes, there are not more, say, critical weather situations going on. I think those issues need to be looked at with an open mind and that both sides can look at it scientifically.

Thank you very much.

Chairman SMITH. Thank you, Mr. Rohrabacher.

The gentlewoman from Illinois, Ms. Kelly, is recognized for her questions.

Ms. KELLY. Thank you, Mr. Chair.

Ms. McCabe, as you likely are aware, critics of this and virtually any other EPA proposed rule often claim that the economy and the American consumer will suffer as a result of efforts to make our environment cleaner and safer. More ''the sky is falling'' attitude toward actions that will protect the health of Americans is contradicted by the fact that the U.S. economy has tripled in size since the adoption of the Clean Air Act in 1970, which you know. One of the concerns often raised is that the Clean Power Plan will cause residential electricity prices to increase dramatically. Can

you comment on that? Is that the case? And can you please describe the estimated impact that the proposed rule will have on Americans' electricity bills?

Ms. MCCABE. Absolutely. Thank you for the question.

Ms. KELLY. Coming from Illinois, it is very important.

Ms. MCCABE. Yes, yes, for me, too. Yes, this is an issue that we look at in our regulatory impact assessment, which was put out with the proposed rule. We did take a look at the anticipated impacts on electricity bills, and because of the strong emphasis that we expect from States in looking at energy efficiency as a very clear and obvious and cost-effective approach, our analysis predicts that electricity bills for American families will go down by 2030 by about 8 percent, and that is a good thing for all of us because you get the improved environment, you get the pollution reduction of other pollutants that come along with the carbon that will have immediate impacts on people in their neighborhoods and improve their health, and you also, through the increased use of energy efficiency, will get lower electric bills.

Ms. KELLY. Where do you feel that your doubters or critics are getting their information from?

Ms. MCCABE. I don't know that I can speak to that, Congresswoman. People do the analyses that they choose to do. What we appreciate is the transparent and public process

that we have during this proposal so that people can bring whatever analyses they have to us and everybody can take a look at that and we can work through it.

Ms. KELLY. Okay. Thank you very much. I yield back.

Chairman SMITH. Thank you, Ms. Kelly.

I now recognize myself for questions next.

And, Dr. Holdren, let me direct my first question to you. The EPA says that its regulations will reduce carbon dioxide emissions by about 555 million tons per year in 2030. That same year, Department of Energy is projecting that China alone will emit about 14 billion tons of carbon dioxide every year. That means that after this costly and in my view burdensome rule is implemented, it will offset only 13 days of Chinese carbon dioxide emissions and of course much less of the total world's emissions. And my question--and I want to focus on the impact of the rule. We will get to the impact on other countries in a second. But would you agree that the impact of the rule when--and if implemented would have a negligible impact on climate change?

Mr. HOLDREN. As I have already said, this rule is a start. The Climate Action Plan is a start. If we do not make a start, we will never get to the kinds of reductions--

Chairman SMITH. Right.

Mr. HOLDREN. --that we need. But by the way, we will never get there without the Congress' help.

Chairman SMITH. Right.

Mr. HOLDREN. It is one of the reasons I feel happy to be here.

Chairman SMITH. What impact would this rule have on global temperatures, for example?

Mr. HOLDREN. A small impact if we neglect the leadership role that the United States plays in the world.

Chairman SMITH. And--

Mr. HOLDREN. I have just been traveling around the world talking to leaders--

Chairman SMITH. I am going to get to the--

Mr. HOLDREN. --of other countries--

Chairman SMITH. I am going to get to the leadership question--

Mr. HOLDREN. --and they are appreciative--

Chairman SMITH. --in just--

Mr. HOLDREN. --of what we are doing.

Chairman SMITH. Dr. Holdren, let me finish. I am going to get the leadership question in a minute but I want to get to the impact of this rule on climate change. You said it would have a very small impact on global temperatures. What about its impact on the rise in sea levels?

Mr. HOLDREN. That impact will also be small. And again, it is necessary to start or we will be cooked and flooded.

Chairman SMITH. I understand. I just want to make sure that everybody understands the impact of the rule on climate change is going to be small, I would say negligible given what I have said.

And as far as our leadership role goes, to me that is totally hypothetical and speculative. You have got China today building on the average I think of one new coal-fed power plant every week and I don't think these other countries are going to have much of an incentive to follow anybody's lead if it is going to cost them more money and damage their economy. But I am glad to have your answers on the small impact on climate change.

Mr. HOLDREN. Can I answer the other point about our leadership--

Chairman SMITH. Well--

Mr. HOLDREN. --and about China--

Chairman SMITH. I think--

Mr. HOLDREN. --and about India?

Chairman SMITH. I think you already have today a couple of times, but I would like to go to Ms. McCabe, and then if we have time come back to that. The question--as I say, to me the impact on other countries is hypothetical.

Ms. McCabe, let me ask you some of these same questions, but on the way there you said a minute ago that the rule is about cutting out carbon pollution. The EPA Administrator,

your boss, said when she testified before the Senate that this is not about pollution control. Why the contradiction in your statement and the Administrator's statement?

Ms. MCCABE. Well, I am not familiar with exactly what statement you are referring to. She may have been talking about the fact that there are technologies that would not be considered the traditional pollution control--

Chairman SMITH. Right.

Ms. MCCABE. --types of technologies that--

Chairman SMITH. Okay.

Ms. MCCABE. --are available to reduce--

Chairman SMITH. If--

Ms. MCCABE. --carbon--

Chairman SMITH. On the surface it looks like they are contradictory statements but we will look for another explanation.

Let me go back and ask you some of the same questions I just asked Dr. Holdren. What impact will this rule have on global temperatures? Is it going to be small, is it going to be great, is it going to be--what?

Ms. MCCABE. Well, I certainly would defer to Dr. Holdren on the science questions. I would agree with him that the impacts of any single action will be small, but it takes many small actions to make a difference on this global problem.

Chairman SMITH. Right. And the impact would be small on global temperatures and the impact would be small on any sea level rise as well, would it not?

Ms. MCCABE. Again, it takes many, many actions--

Chairman SMITH. I know but the answer--

Ms. MCCABE. --to make the difference.

Chairman SMITH. --to my question is that it would be a small impact and you would agree with Dr. Holdren?

Ms. MCCABE. I would agree.

Chairman SMITH. Okay. Thank you both very much. You have answered my questions.

And we will now go to the gentleman from California, Mr. Swalwell, for his questions.

Mr. SWALWELL. Thank you, Mr. Chairman.

And first, I just want to start with Dr. Holdren. Dr. Holdren, you know, we heard a little bit about scare tactics earlier, but I wasn't around in 1970 when the Clean Air Act was passed. I came on the scene about 10 years later. But when the Clean Air Act was passed, everything I have read was that there were a number of scare tactics from industry around what it would do to our economy. Do you remember that?

Mr. HOLDREN. I do.

Mr. SWALWELL. And--

Mr. HOLDREN. I do.

Mr. SWALWELL. And one of the scare tactics was that we would see our economy, rather than move forward, that the economy would move backwards. Do you remember that?

Mr. HOLDREN. I do.

Mr. SWALWELL. And isn't it true that in fact our economy has tripled in size since the Clean Air Act was passed in 1970?

Mr. HOLDREN. I think that is roughly right. I would have to double-check the figure.

Mr. SWALWELL. And isn't it true that pollutants have been reduced by 70 percent since the Clean Air Act was passed in 1970?

Mr. HOLDREN. At least many of the important ones have.

Mr. SWALWELL. Okay. Did you read the New York Times story over the weekend on Germany's solar and wind investments?

Mr. HOLDREN. I did.

Mr. SWALWELL. Do you believe that the United States is any less capable than Germany in making investments in solar and wind? And what would it mean for reducing carbon emissions if we made investments that would have us have 30 percent of our energy supplied by renewables, as Germany is on track to do by the end of the year?

Mr. HOLDREN. We are not technically less capable. We may be politically less capable of taking the necessary

decisions.

Mr. SWALWELL. And what would it do for our Climate Action Plan if, over the next 15 years, we achieved what Germany is going to achieve by the end of this year, which is having 30 percent of its energy provided by renewables?

Mr. HOLDREN. It would obviously be a great help.

Mr. SWALWELL. Okay. And, Ms. McCabe, do you have any thoughts on that?

Ms. MCCABE. No, I would just confirm that we think increased use of renewable energy is going to be a key portion of States' plans that they can choose to develop. So I would agree.

Mr. SWALWELL. Also, Dr. Holdren, many have mentioned that even if we do something, that other countries--some of the bigger countries, China and India, if they do nothing, that our efforts could be negligible. However, don't we have some recourse to enforce or require other countries to take action? For example, can't nations that are being responsible--that are not being responsible in addressing this global threat be slapped with a WTO complaint tariff?

Mr. HOLDREN. Let me say that at this point I don't--

Mr. SWALWELL. Sorry, WTO compliant tariff.

Mr. HOLDREN. I think at this point we don't need to talk about recourse because the fact is that both China and India, the second and third biggest emitters in the world,

are both taking far more action than most Americans realize. The Chinese in their 12th 5-year plan put a target for reducing the percentage--a target for increasing the percentage of non-fossil fuel in primary energy consumption. We, by the way, have not done that. We don't have any non-carbon or low carbon energy standard. China has set specific national targets for the expansion of nuclear, wind, solar, and natural gas. They have a carbon intensity target, which they are on track to meet. They have minimum energy efficiency standards across a wide range of appliances and vehicles.

Mr. SWALWELL. And, Dr. Holdren--

Mr. HOLDREN. And they have been shutting down their old coal-burning power plants--

Mr. SWALWELL. I appreciate you bringing that up because--

Mr. HOLDREN. --and replacing them with more efficient ones.

Mr. SWALWELL. --I want to put into the record if it is okay with the Chair two stories that backup what Dr. Holdren is saying, one, a September 12, 2014, story, ''China Aims High for Carbon Market by 2020,'' and also a May 7, 2014, story, ''India Goes Green, Drafts Policy to Lower Carbon Emissions.''

Chairman SMITH. Without objection, those two articles

will be made part of the record.

[The information follows:]

********** INSERTS 7, 8 **********

Mr. SWALWELL. Thank you, Mr. Chair.

So I think the question that we are tasked with today is do something or do nothing, and as far as I am concerned, plan always beats no plan, especially when the stakes are so high. And so I guess I would challenge my colleagues on the other side if they want to do nothing, why don't we go ahead and build a do-nothing climate wall. We can put it somewhere out on the Washington Mall and we can put all the names of the people who think that we should do nothing, and then in 100 years we can let our children and grandchildren go to that wall and see who wanted to do nothing and who wanted to do something. And I hope we did something and we will let history be the judge of what happens next.

Mr. ROHRABACHER. Will the gentleman yield for a question?

Mr. SWALWELL. And I yield back the balance of my time.

Mr. ROHRABACHER. Would the gentleman yield for a question?

Mr. SWALWELL. I yield back.

Chairman SMITH. The gentleman has yielded back.

Thank you, Mr. Swalwell, and we will now go to the gentleman from Ohio, Mr. Johnson, for his questions.

Mr. JOHNSON. Thank you, Mr. Chairman. Thank you, folks, for joining us today.

Ms. McCabe, I would like to start out, you acknowledged

in agreement with Dr. Holdren that the rule would have a small impact in the climate spectrum. Do you also view the thousands of jobs and the economic impacts of these rules on the American people as small impacts?

Ms. MCCABE. We--Congressman, we take very seriously any expected impacts on the economy when we consider our rules--

Mr. JOHNSON. Well, the--you know, the experts are saying, Ms. McCabe--you know, I represent a district in Ohio that has six coal-fired power plants; I have got roughly 15,000 or so coal industry-related jobs. If these rules go forward, those jobs are going to be forfeited. So my question to you is do you view those as small impacts?

Ms. MCCABE. I think that any job concerns to a community are significant and need to be paid attention to. This rule is--

Mr. JOHNSON. Are they acceptable to you?

Ms. MCCABE. This rule is being written in the context of a transitioning energy system, and--

Mr. JOHNSON. Let's talk about that for a second. Transitioning energy position, you know, during this past winter the polar vortex, the cold snap, many coal-fired power plants that are slated to retire were running at over 90 percent capacity. In Ohio I have heard the experts say that we were one coal-fired power plant away from rolling brownouts and blackouts. And I am already getting

manufacturers today that are being asked to idle their manufacturing plants because there is not enough energy on the grid.

So how would the grid have performed this past winter and how high would have wholesale prices risen if the coal-based load of power plants scheduled to close over the next 2 years, if they were not available this past winter? What does your analysis reveal about that? You take all that power off the grid, how would that have affected the price for energy and--this past winter?

Ms. MCCABE. The Clean Power Plan envisions that in 2030, 30 percent of--

Mr. JOHNSON. I am not talking about 2030; I am talking about last winter. How would it have affected the wholesale prices if that energy had not--that you are planning to take off the grid, if it had not been available? How would it have affected wholesale prices?

Ms. MCCABE. EPA is not planning to take any power off the grid. This plan would allow States to develop plans and we see that energy reliability would not be compromised under the plan as we have devised it.

Mr. JOHNSON. Okay. Well, the States have a different view of that I think. Let me ask you this, then, talking about the States. You know, explain it to me then how you intend to approve or disapprove of a State plan if the State

submits a plan that has a different baseline than those that are set out in the proposed rule because the EPA's generation mix for 2012 doesn't include all the utilities that usually operate, for example, they were shut down that year or they did not operate?

Ms. MCCABE. Um-hum.

Mr. JOHNSON. Will the EPA disapprove a State plan that sets a different reduction target than what the Agency requires in the proposed rule because it failed to include a utility that did not operate in 2012?

Ms. MCCABE. This is why our rulemaking has a public process with opportunities for people to give us information. We want to make sure that the targets that we ultimately finalize are accurate and correct and based on correct information, and we are in those discussions with States every day now to make sure that we have that right information.

Mr. JOHNSON. Okay. Dr. Holdren, and--during--you talked about success through science in your opening statement this morning. Last July, Steve McConnell, the former Assistant Secretary for Energy until last year, now at Rice University, testified before this committee that the relationship between the DOE and the EPA was really disingenuous interagency collaboration and simply a box-checking exercise. Further, it was an awkward--he said

it was an awkward dance because very often the inconvenient truths of technical evaluations didn't fit the political agenda and that made it very difficult to actually have any collaboration, and in fact, as time went, on the communication became almost zero.

Mr. McConnell gave an insightful example of where EPA's idea of checking the box on a 650-page technical document to the Department of Energy at 3:00 p.m. on a Friday afternoon that EPA told him they had to respond back by 10:00 a.m. on Monday.

So you are in charge of scientific and technical cooperation between departments and agencies. Is this how the Obama Administration makes technical decisions that will cost the American taxpayers billions of dollars? Is this what you call success through science? Or is it simply a political agenda to shut down coal-fired power plants across the country?

Mr. HOLDREN. It is certainly not a political agenda to shut down coal-fired power plants, and as you know--as I believe you know, under the Climate Action Plan, coal would still be providing 30 percent of U.S. electricity at the end of--at the period in 2030.

But in terms of interagency cooperation, of course we want and we encourage interagency cooperation. I am responsible for the oversight of activities and initiatives

that involve the cooperation of multiple agencies. We work hard at getting that to happen. I think it is happening. I think both EPA and DOE currently have not only very capable but very collaborative leaders in Secretary Moniz and Administrator McCarthy. I have seen them working closely together. I have seen the process of collaboration. I am not sure what happens when--

Mr. JOHNSON. All right. Well, let me--my time is almost expired so let me ask Ms. McCabe then.

Mr. ROHRABACHER. [Presiding] There is--

Mr. JOHNSON. Will you--

Mr. ROHRABACHER. Your time has expired--more than expired. Thank you.

And--

Mr. JOHNSON. I yield back.

Mr. ROHRABACHER. --now, Ms. Edwards.

Ms. EDWARDS. Thank you very much, Mr. Chairman.

And, Dr. Holdren, and to both of our witnesses, thank you very much for being here.

I think that we could not be dealing with any more important issue than this discussion right here and we need to get off the dime on the politics because we are losing ground every single day.

And I would like to ask the Chairman, I have an article from the Washington Post that just appeared a couple of days

ago that highlights the impact--the potential impact to flooding from storm surge that would threaten D.C.--the District of Columbia infrastructure. And I would note it is a shame that Mr. Swalwell is no longer here and he has left because I would tell him that if he were going to build that wall on the Mall, he should choose a different place because it will be underwater.

And so with that, Mr. Chairman, I would like to enter this article from the Washington Post appearing September 16 into the record.

Mr. ROHRABACHER. Without objection.

[The information follows:]

********** INSERT 9 **********

Ms. EDWARDS. Thank you.

Dr. Holdren, as we have just indicated, you know that our coastal communities are a major contributor to the U.S. economy that supports maritime commerce and shipping ports, fishing, tourism. I know Maryland has a great benefit to our economy because of our coast and our Chesapeake Bay. And all of these areas are highly vulnerable to the threat of sea level rise.

In addition, in the Maryland Chesapeake Bay, the five States that comprise the watershed, that there is a lot of farmland there, too, and so in addition to the economy that takes place on the water, there is the economy just bordering the water that really threatens us. The third National Climate Assessment asserts that more than a trillion dollars of coastal property and infrastructure is at risk if inundation from a sea level rise of 2 feet above the current level. Can you outline the potential impact a 2 foot rise in sea level would have on the American economy?

Mr. HOLDREN. Well, let me say a couple of things about that. One is that is quite extensively analyzed in the National Climate Assessment that came out in May. The second point is that the first phase of the Climate Data Initiative, which is part of the President's Climate Action Plan, and the first phase of the Climate Resilient Toolkit, which will be rolled out shortly, are both focused on providing more

detailed data on the consequences of sea level rise of various levels on infrastructure and on the economy.

And so while we already have rough accounts of how devastating sea level rise in that magnitude would be, we will soon have better ones that we will have tools that will enable people on the coast all around the country to understand, anticipate, prepare for, and plan for the amounts of sea level rise that are likely to occur in their areas.

Ms. EDWARDS. Dr. Holdren, just to follow that up, I recall that just a couple of months ago there was another article--I think it was either in the New York Times or Washington Post--that talked about particular impacts in the Virginia Beach and Norfolk area to our military facilities. And in fact, as part of our military readiness and planning, they have tried to accommodate for that kind of rise. We put billions of dollars into structuring and restructuring, rebuilding our ports to accommodate our military bases and facilities because our Department of Defense actually does believe that there is a tremendous impact of climate change contributing to sea level rise.

Has there been an assessment of the threat to our defense--our national defense and military readiness?

Mr. HOLDREN. There have been a number of reports by the Pentagon and by consultants to the Pentagon on the impacts of climate change on national security, and I would refer you to

those. You are absolutely right, Congresswoman Edwards, that the Pentagon recognizes very clearly that climate change is a big challenge for our military and for our national security.

Ms. EDWARDS. Thank you very much. And just to be clear, though, when we are thinking about the impact to the economy on our coastal communities, do we have a rough estimate--is there a rough estimate of how much of the population just on the two coasts, the Atlantic and the Pacific, that is attributed to--that would be impacted by sea level rises?

Mr. HOLDREN. I am just in the process of looking up a number--excuse me. I am just in the process of looking up the number in the National Climate Assessment. There is an estimate in there of what fraction of the U.S. population lives at various heights above current sea level. I don't recall it off the top of my head.

Ms. EDWARDS. Let's just say it is a boatload of people, right?

Mr. HOLDREN. I would be happy to get back to you with a quantitative answer on that.

Ms. EDWARDS. Great. Thank you very much for your testimony.

Mr. ROHRABACHER. Thank you very much.

Mr. Bridenstine.

Mr. BRIDENSTINE. Thank you, Mr. Chairman.

When the President was campaigning in 2008 he--they--he was interviewing with the San Francisco Chronicle and they asked him--quite infamously they asked him, you know, are you going to shut down coal-fired power plants? And his response was, well, no, I am not going to shut them down; I will just--we will increase regulations to the point where it is so expensive, they won't be able to stay in business. I would like to ask each of you, do you agree with the President's philosophy on that?

Mr. HOLDREN. Well, first of all, I am sure the Resident no longer agrees with it. Whatever he said in 2008, he--

Mr. BRIDENSTINE. So that is not the President's philosophy?

Mr. HOLDREN. It is not the President's philosophy.

Mr. BRIDENSTINE. Okay. That is good.

Mr. HOLDREN. The President is not trying to--

Mr. BRIDENSTINE. So you don't agree with it? Yes or no, you don't agree with it?

Mr. HOLDREN. I don't agree with the statement as you just presented it--

Mr. BRIDENSTINE. Okay.

Mr. HOLDREN. --that the President--

Mr. BRIDENSTINE. Ms. McCabe?

Mr. HOLDREN. --apparently said in 2008, and he doesn't

either.

Ms. MCCABE. Absolutely, we don't agree.

Mr. BRIDENSTINE. Okay. So has he recanted that or retracted it or apologized for suggesting that?

Mr. HOLDREN. The National Climate Plan makes very clear--Climate Action Plan makes very clear that we do not intend to shut down coal-fired power plants, and it is the President's plan. So I say he is absolutely clear on the record on that and he has said it in a number of recent speeches as well.

Mr. BRIDENSTINE. Okay. Chuck McConnell is the Executive Director of the Energy and Environment Initiative at my alma mater, Rice University. He is a former Assistant Secretary of Energy and this Administration, and he testified before this committee about the environmental impacts of the Administration's carbon plan that you have just mentioned, or rather the lack of the impact of the environmental plan. He says that the reductions in emissions resulting from these rules will account for less than 1/100th of 1 degree Celsius drop in temperatures. Do you guys agree with that?

Mr. HOLDREN. I don't agree with it for the reasons I have already stated, namely, we are beginning a process that is going to lead to further reductions.

Mr. BRIDENSTINE. No, no, no, no, this rule--no, no--

Mr. HOLDREN. This rule alone--

Mr. BRIDENSTINE. Do you agree with that statement, 1/100th of 1 degree Celsius?

Mr. HOLDREN. I would have to look--have to review the number before I--

Mr. BRIDENSTINE. These are your models.

Mr. HOLDREN. --before I subscribe to a particular--

Mr. BRIDENSTINE. These aren't my models; these are your models and--now, he also suggested--

Mr. HOLDREN. I will be happy to review the number and get back to you--

Mr. BRIDENSTINE. Sir, this is my time--

Mr. HOLDREN. --but the point is this is a start.

Mr. BRIDENSTINE. Sir, I am asking the questions here. He also suggested that it would increase sea levels by 1/3 of the width of a dime over 30 years. Do you agree with that assessment?

Mr. HOLDREN. Again, I will get back to on the specific numbers but the assessment is irrelevant. We are starting a process which is going to require larger emissions reductions going forward--

Mr. BRIDENSTINE. By China? We need larger--

Mr. HOLDREN. Oh, absolutely we do and China is already on that pathway as well.

Mr. BRIDENSTINE. Oh, I--

Mr. HOLDREN. And in some respects they are ahead of us.

Mr. BRIDENSTINE. I am glad to hear that China is on board with our plan because they weren't on board with our plan when we wanted to protect international waters in the South China Sea, were they?

Mr. HOLDREN. We are not talking about the South China Sea; we are--

Mr. BRIDENSTINE. No, we are because the South--

Mr. HOLDREN. --talking about climate change.

Mr. BRIDENSTINE. --China Sea is their next move and they are doing it for energy purposes. And guess what? They didn't consult the Philippines, they didn't consult Vietnam, they didn't consult Malaysia or Indonesia, they didn't consult Taiwan. They just went ahead and said we now control the South China Sea. Now is--was that in the plan?

Mr. HOLDREN. I am not defending what China has done in the South China Sea.

Mr. BRIDENSTINE. Well, let me ask you--

Mr. HOLDREN. What I am saying is China finds it--

Mr. BRIDENSTINE. --I am going to ask you a very important question--

Mr. HOLDREN. --in its own interest--

Mr. BRIDENSTINE. Does China--

Mr. HOLDREN. --to reduce greenhouse gas emissions--

Mr. BRIDENSTINE. Does China do what is in our interest

or do they do what is in their interest? Because what we have seen is they do what is in their interest and encourage us to do what is against our own interest. Do you agree with that?

Mr. HOLDREN. No, I do not. In the case of climate change it is in both our countries' interest to reduce both of our greenhouse gas--

Mr. BRIDENSTINE. Then why are they continuing to--

Mr. HOLDREN. --and that is why we are cooperating--

Mr. BRIDENSTINE. --increase their emissions?

Mr. HOLDREN. --in that domain.

Mr. BRIDENSTINE. You recognize that they are continuing to increase their emissions, and the more we reduce ours, we hinder our economy while their economy is growing more rapidly, is that correct?

Mr. HOLDREN. They are continuing to increase their emissions but at a declining rates, and they are aiming to peak and then decline at--currently, we expect that China will be announcing an intention to peak by 2030 and we--

Mr. BRIDENSTINE. Well, I am glad they are going to--

Mr. HOLDREN. --hope--

Mr. BRIDENSTINE. --peak in 2030.

Mr. HOLDREN. And we hope that they will move that forward as the technological capabilities to do it become available.

Mr. BRIDENSTINE. I have got 30 seconds left. The Mayor of Tulsa was here today, Dewey Bartlett. He is a good friend of mine. He would like me to ask you guys if you are aware that 50 percent of the total electricity output for Oklahoma comes from coal. Are either of you aware of that, 57 percent of our electricity output comes from coal in the State of Oklahoma?

Ms. MCCABE. There are a number of States where a significant portion comes from coal and we expect that to continue.

Mr. BRIDENSTINE. In Oklahoma we have a 20 percent lower cost of electricity than the national average. Are you aware of that?

Ms. MCCABE. Not specifically but I--it doesn't surprise me.

Mr. BRIDENSTINE. So when these rules go into effect, do you know what happens? Manufacturing jobs that have a high cost of energy, manufacturing jobs leave Oklahoma. And guess what? It is a lot more difficult to attract jobs to Oklahoma. Are you guys aware of that? So even though you suggest that this may grow the economy, right now, that is not how it is working in my State of Oklahoma.

I am out of time but this is something you need to think about. Thank you so much.

Mr. ROHRABACHER. Thank you.

Mr. Posey from Florida.

Mr. POSEY. Thank you very much, Mr. Chairman.

Thank you, Dr. Holdren and Ms. McCabe for coming here today. I know sometimes it is really not fun here and I hope it is not intended as a bunch of grouches. I mean I hope everybody is really trying to find common denominators and trying to make common sense meets science and get a good handle on this and I think that if there is enough debate, someday it will probably level out and most people will share the same opinion, but there is just a lot of digging to get there.

And, you know, for the hundredth time, you know, I believe in climate change, never said I didn't believe in climate change. Some people have claimed that I said I did--I never--I defy anybody to say I don't believe in climate change. I think the last time Dr. Holdren was here we discussed climate change. I talked about the temperature of the Earth 65 million years ago being significantly hotter than it is now and some lame-brained blogger, you know, willfully and wantonly distorted the fact to say I said it didn't bother the dinosaurs, why should it bother us? So there is a lot of venom flowing on both sides of this issue, which I am afraid hinders more direct discussion of the fact, and that is real unfortunate.

You know, I think from my perspective, you know, the

overarching interest in the issue and the common ground that I think everybody has is it is important that we have clean air and clean water for everybody. I mean every generation--everybody is healthier if we have clean air and clean water, and I think that is kind of where you are trying to go and I think that is where the so-called other side is trying to go, too, but there are just some things they want to quantify. And, you know, science should be questioned. Everybody's opinions should be questioned. Mine should be questioned, yours should be--everybody's should be--and that is what we do here.

Sadly, like I say, sometimes it gets a little more acrimonious than it needs to be. Sometimes the people that come in here and say politics shouldn't be involved in this are the most political people and politicize it the most, but that is unfortunate.

But my interests, getting to the crux of it, is still trying to have some kind of quantification rather than just platitudes. They say, well, we do a bunch of little things and add up to a big thing. You know, I understand that and I think everybody understands how that might work, but it is still just trying to quantify it. And, you know, somebody talks about a dime thin worth of coastal rise but, you know, what I am still kind of searching for is to quantify what man's contribution in the United States of America is to

climate change. I mean I know we are having it, you know, and everybody knows. I mean you learned as a young child the longer you stand in front of the fireplace, the warmer you get generally speaking unless there is extenuating circumstances.

But I just--and you don't want--you don't have to do it now. I am not--you know, I am not trying to do a gotcha, but I--that is really what I am looking for, and if you can drop me a note on that, that is okay. I mean, you know, it doesn't have to be a big arena question, just trying to quantify if we go--if we take these steps, you know, at the end of the day, you know, what really difference is it going to make? And I am not saying it is worth it or shouldn't be worth it or whatever we do for clean air and clean water isn't important. I think everything that we do is. But just to kind of start working on the equation, it would be good to know, you know, what we attribute to the natural heating of our planet and do we expect that to continually increase, and then, you know, to what extent mankind directly affects it, and then more particularly to what extent the United States of America directly affects it. And I think that will put a lot of questions of a lot of other people in perspective, too, if we ever reach that--if we ever get that point. And either one of you can respond. You know, I am not trying to be argumentative but--

Mr. HOLDREN. Well, Congressman Posey, first of all, I appreciate your opening comment about the need for continuing discussion and the hope for ultimate convergence. That is an appropriate sentiment.

I would note, first of all, that in my long statement there is a lot of quantitative information and there is reference to much more, and the facts as we understand them are that natural climate change, if it was the only thing that was happening, the world would be in a long-term cooling trend. So the fact that is embraced by the vast majority of the scientific community who study these matters is that virtually all of the warming trend we have seen in the last several decades has been caused by human activities and most specifically by emissions from fossil fuel combustion, secondarily from deforestation and land-use change.

The second point I would make is although you are absolutely right that climate has been changing for the whole history of the Earth for a whole variety of reasons, it is changing many times faster now than it changed before. And the problem that poses is that the ability of society to adapt and ecosystems to adapt is stressed and potentially ultimately swamped.

Sixty-five million years ago when it was 13 or 14 degrees centigrade above the current temperature, the sea level was probably about 70 meters above the current sea

level. We believe that the polar caps were free of ice at that time. All that ice was in the ocean and that makes sea level 70 meters higher. Also, 65 million years ago we didn't have 7 plus billion people to feed, house, and try to make prosperous.

So while you are absolutely right the temperature has varied enormously over the millions of years, that should be no consolation in the current situation where we are driving the temperature up at an unprecedented pace.

Mr. ROHRABACHER. Your time is up and the Chair will now be switching to Mr. Schweikert from Arizona.

Let me just add as I leave for my next assignment that we thank--I personally thank the witnesses and where we have some fundamental differences or disagreements, we certainly should keep our minds open and try to be--try to get to what really is the science. And let me say in other areas we agree.

And, Mr. Holdren, I want to congratulate the White House on your recent decision to assign commercial contracts for space transportation and resupply of the space station, Debian, and Space Acts.

Mr. HOLDREN. Let me just say that was NASA's decision, but thank you for your approval.

Mr. ROHRABACHER. You might have had something to do with it. If you did, thanks.

Mr. HOLDREN. Okay.

Mr. ROHRABACHER. And with that, Mr. Schweikert.

And Mr. Stockman will be taking Mr. Schweikert's position in line. Thank you.

Mr. STOCKMAN. Thank you. I have a--some of the statements that were passed around today was the investments in Europe and--in climate change, and I think what was left out of the record was that Spain sold climate change bonds to its populace and guaranteed by the government and the government now has rescinded that guarantee and they lost a tremendous amount of money.

And so for the argument only point to Germany without pointing to Spain's failure, we would be remiss in the record to leave that out. Many Spaniards lost their entire savings investing in climate change technology.

Also, too, I hear repeatedly, you know, well, Obama is not going to close plants. I don't think anybody suggested that Obama is going to close plants. I think what we are suggesting is the policies will close plants, and that seems to bear out with the predictions are coming true across the country and what plants have to be closed.

In reference to China, I was just there. The embassy said that their level of measuring of pollution was so high that their equipment could not measure it and there is now a key factor in moving to Beijing that you are given

compensation because you can't even breathe the air there, and many people working there, including some of the embassy staff, are not willing to work in Beijing it is so bad. And I actually asked some of the Chinese officials if they thought they could meet their climate projections and they laughed. They don't believe it and I don't think we should either.

And my colleague over here who said we are in a do-nothing caucus, may I remind the colleague by his own testimony that the EPA was created by a Republican and he, by his own admission, says that the pollution has gotten 70 percent better. So I would argue that that is not do-nothing; that is actually has done something.

And I went to Maryland and asked repeatedly two things which I have never been able to get answers on. One was I said what ended the Ice Age? And the lead scientist at NASA said this: He said that what ended the Ice Age was global wobbling. That is what I was told. This is a lead scientist down in Maryland. You are welcome to go down there and ask him the same thing.

So on my second question, which I thought was an intuitive question that should be followed up, is the wobbling of the Earth included in any of your modeling? And the answer was no. So how can you have wobbling of the Earth cooling the Earth and not be included in any projections?

That is one for the books that I am a little bit confused about. How can you take an element which you give to the credit for the collapse of global freezing and then to global warming but leave it out of your models? I am a little bit puzzled because we still don't have any metrics I understand of what--how to determine global wobbling, which I didn't know was part of the reason for the end of the Ice Age.

The last thing I asked him which I can't get answers to is, you know, how long will it take for the sea level to rise 2 feet? I mean think about it, if your ice cube melts in your glass, it doesn't overflow. It is displacement. I mean this is the thing--some other things that they are talking about that mathematically and scientifically don't make sense.

But I just--I am wondering overall when you have a model and you say we are going to leave out the most important impact of that model out of our theory and not talk about global wobbling, how can you make projections?

So I am concerned that while again you are saying Obama is not closing plants, you are correct on that note, which we here in Congress and other places take these words very seriously, but the policies will do exactly that. It will close plants and it has in Texas and it will around the country. And unfortunately, China I know firsthand is laughing at their own predictions. And with that, I will let

you respond, but if you have a model with global wobbling, please let me know and let me know how long it takes the seas to rise 2 feet.

Mr. HOLDREN. Congressman Stockman, I am not going to talk about the economy of Spain; that is not my expertise, but I am going to talk about the science and help you a little bit with global wobbling to start with. Global wobbling, which refers to changes in the Earth's tilt and orbit, takes place on characteristic timescales of 22,000 years, 44,000 years, and 100,000 years. It is very slow. It brought us into ice ages; it brought us out of ice ages. When you take global wobbling into account, as I have already suggested, we would be in a cooling period now, but the warming inflicted by human activities has overwhelmed the effect of global wobbling.

Mr. STOCKMAN. But I was told--

Mr. HOLDREN. You don't have--

Mr. STOCKMAN. Wait a minute. None of the models have global wobbling in them. Is that true?

Mr. HOLDREN. And I am about to explain why. The reason why is that global wobbling is a tiny effect on the timescale of 100 years in which we try to run these models to understand what is going on now and going on soon. It is so small--

Mr. STOCKMAN. No, with all due respect--

Mr. HOLDREN. --and it is so small that you don't--

Mr. STOCKMAN. No.

Mr. HOLDREN. --need to put it in.

Mr. STOCKMAN. No, you can't say it had a global impact and then is small both. Those are the kind of statements--

Mr. HOLDREN. It had a global impact over periods of tens of thousands and hundreds of thousands--

Mr. STOCKMAN. So you are saying the Ice Age--

Mr. HOLDREN. --of years. We are talking about decades--

Mr. STOCKMAN. --took hundreds of thousands of years to end?

Mr. HOLDREN. Ice ages--

Mr. STOCKMAN. How long did the Ice Age take to end?

Mr. HOLDREN. Ice ages went on for hundreds of thousands of years--

Mr. STOCKMAN. That is not what I am asking you--

Mr. HOLDREN. --in some cases for millions--

Mr. SCHWEIKERT. [Presiding] Mr. Stockman--

Mr. HOLDREN. --and they ended over long periods of time as well as a general matter.

Mr. STOCKMAN. Doctor, I would just ask you if you could give me your model--

Mr. SCHWEIKERT. And sorry, I don't mean to step on anyone. It is just as the chaos of today, everyone is going

to be running on to other hearings.

Mr. Weber.

Mr. WEBER. Thank you. Appreciate you all being here. Mr. Holdren, you just, in your exchange with Congressman Stockman, said that the economy of Spain is not your expertise, and I would probably venture to add that the economy of the United States is probably not your expertise either. Is that fair to say?

Mr. HOLDREN. That is correct. In respect to the economy of the United States, I rely on folks like the Council of Economic Advisors and the National Economic Council--

Mr. WEBER. The reason I bring that up is because the last thing we want is an unintended consequence, which Congress seems to be good at I might add, whereby the policies coming out of the Administration, the EPA, or any of the other agencies have that unintended consequence of actually harming our economy. And so we are--I try to be keenly in tune with that. I just want to make that point.

Very quickly, in January of this year, a very cold January I might add, you filmed a short video for the White House website entitled ''The Polar Vortex.'' In that video you said, ''a growing body of evidence suggests that the kind of extreme cold being experienced by much of the United States as we speak is a pattern that we can expect to see

with increasing frequency as global warming continues.'' And in many--scientists on both sides of that issue quickly took issue with that. A complaint was filed with the agency seeking to correct it under the Federal Information Quality Act, yet your office claimed this was an expression of your personal opinion. Is that accurate?

Mr. HOLDREN. It is accurate, and as the President's Science Advisor, I express my personal opinion on the balance of science all the time.

Mr. WEBER. Okay. And if that was nothing more than a personal opinion, were White House resources spent on producing that video?

Mr. HOLDREN. I stated in the video that it was my judgment that we would see more of this. I believe that to be true.

Mr. WEBER. But my question was about the money. Who paid for the video?

Mr. HOLDREN. I assume that the--

Mr. WEBER. Okay.

Mr. HOLDREN. --White House Digital Services paid for the video.

Mr. WEBER. You are contributing to the economy then, so maybe the economy is part of your forte because some production company made out on that deal.

Let me go to the regulation that you are proposing here

and let me--I want to jump over the ozone rule for just a minute and the EPA has a track record. I am from Texas. Texas has about 1,200 people a day moving there. We have dropped our carbon emission 4 percent in the last almost 10 years while we have gained 4 million people to a population of 25 million, so that is a pretty hefty sum, a little over 20 percent I guess or about--not quite 1/5.

So the ozone proposal that you all put forward would cost $90 billion with a B lowering the ozone standard, and yet earlier you said to Jim Bridenstine that the assessment was irrelevant that he was trying to make the connection on. So if $90 billion annually it is going to cost to business, are you still prepared to say here today that won't cost any more for electricity, that the cost of energy that is going to be--that is going to go up because of these kind of regulations really--I realize we are not economy experts here, but do you really sit there and think that industry pays $90 billion a year or more to effect just that one ozone rule and nothing is going to go up?

Ms. MCCABE. Well, Congressman, if your question is about the Clean Power Plan, the economic analysis does show that electricity bills will go down in 2030 because of the effects of energy efficiency.

Mr. WEBER. Well, listen, I applaud you for believing that. I have got some oceanfront property in Oklahoma I

would like to sell, too, so I just--I can't buy that. I mean I do--I own a business so I know how the economy works.

Let me go to carbon for just a second. Texas, as I said, has done a great job, people moving there every day by the thousands, 1,200 a year. And your carbon rule that you are proposing, with Texas cleaning up its air--and I will--and I believe that the EPA will admit that most of the ozone emissions, all right, noxious gas emissions, from non-stationary point sources, i.e., vehicles. Is that true?

Ms. MCCABE. Point sources is a term that refers to stationary sources--

Mr. WEBER. Got that.

Ms. MCCABE. --the emissions that contribute to ozone--

Mr. WEBER. They are coming--let me just short-circuit you. They are coming from cars.

Ms. MCCABE. No--not--no, not predominately. Cars--

Mr. WEBER. Non-stationary point sources, how would you describe that?

Ms. MCCABE. Cars make up about 1/3 of the emissions--

Mr. WEBER. Okay.

Ms. MCCABE. --and utilities, power plants, make up another 1/3.

Mr. WEBER. Those plants seem to be pretty stationary to me but that is just me thinking.

Ms. MCCABE. Right, but they are a significant--

Mr. WEBER. The--

Ms. MCCABE. --contributor to pollution--

Mr. WEBER. I am almost out of time. The point is that Texas has been really increasing their--I want clean air and clean water for my kids and grandkids and for me and for you. Texas has been improving their air and water quality without the EPA's oversight. We have got States that are doing a good job, and unfortunately, the rules that the EPA is proposing are going to put a lot of the country in non-attainment on ozone, going to cost a lot of jobs, so even though we are not economy experts, before we have that unintended consequence, we are going to have to really think long and hard about the data and the scientists--the science used behind this.

And I am way out of time. I apologize but I just want to make that point.

Mr. Chairman, I yield back.

Mr. SCHWEIKERT. Sorry about that. We were working on some of our calendar.

Mr. Bucshon--or, excuse me, Mr. Cramer.

Mr. CRAMER. Thank you, Mr. Chairman.

Thank you, Ms. McCabe and Dr. Holdren, for being here. Good to see both of you again.

I am a little conflicted because I want to focus on the one hand on the reliability issues that Mr. Johnson brought

up earlier but I think I am going to start with the flexibility issues because both the Agency and the Administration--you are quite adamant about the flexibility that the rule provides States, and I am wondering how much flexibility was considered for States with regard to the rate of emissions themselves? I mean did States have much flexibility in determining the emission rates?

Ms. MCCABE. Well, under the Clean Air Act, it is EPA's responsibility to determine the level of reductions to be achieved or the ultimate performance level, but then equally under the Clean Air Act the States have a responsibility but the opportunity to design a plan that achieves those goals using the best system that makes sense for them.

Mr. CRAMER. Okay. So going to another area of flexibility, and this was a question that was raised by a constituent of mine who is in the room, Perry Schafer, who has a small business--a couple of small businesses in North Dakota called Environmental Services. He provides service and sells products to power plants largely. And what--how much analysis under the Regulatory Flexibility Act was put into this rule? First of all, I guess are you familiar with the Regulatory Flexibility Act and what it does?

Ms. MCCABE. I am.

Mr. CRAMER. Okay. So how much--well, how much analysis was put in to consideration of that act and can you perhaps

elaborate a bit on what the findings were and how it is applied in the proposed rule?

Ms. MCCABE. So the industrial sector that is addressed by the rule is the power plant sector and those are primarily large businesses. And so the economic analysis that we do look at the impact that we expect from the types of choices that people will be making in order to comply with the rule given what we see happening in the economy right now.

Mr. CRAMER. So when you are applying the analysis for the Regulatory Flexibility Act, you are considering the flexibility of the power plant but not all these small businesses that are affected by the rule as they impact the power plant. Is that what I just heard you say?

Ms. MCCABE. Well, we look at the approaches that we see being used by States and companies around the country and the types of things that they are doing and look at the expected impacts of those on costs and--on the economy.

Mr. CRAMER. So besides the precedent-setting piece of this, which we haven't even begun to address what the impact will be if this rule goes forward, if it is accepted and becomes the tradition and culture of the land, what impact it is going to have on manufacturing and the rest of the industrial sector, is it not true that the industrial sector depends tremendously on electricity and that it fact whether small business, medium-sized business, or large business,

there is a very direct--not just an indirect--but a very direct economic impact and did the--is the flexibility there to address small business?

Ms. MCCABE. Well, the analysis that we have done shows that the effect actually will be positive by reducing electric bills in 2030 as a result of the energy efficiency, and the rule will lead to significant investment in the kinds of activities that support small businesses across our community and energy efficiency and renewable energy and other technologies.

Mr. CRAMER. Since you brought up this lowering of rates or the lowering of the bills in 2030 due to efficiency, being a former regulator--economic regulator, utility regulator, I know full well that efficiency is not free. It is not even cheap. It may not even be the cheapest alternative, although I know that is commonly thought. But in a State where our retail rates today are--average about between 8 and 9 cents a kilowatt hour, the cost of compliance with efficiency standards is oftentimes greater than the cost of the electricity itself.

And that--and the other thing I would raise is the plants have to be paid for and they have to be paid for over the lifespan of the plant, and if you impose efficiency which costs people--and frankly I think is a greater burden on the poor than it is on the people that can afford the efficiency

methods, doesn't the cost of that plant--the stranded cost still have to be covered one way or another, and whether it is at 8 cents or 9 cents or 10 cents or 30 cents a kilowatt hour, I mean is that all factored in or is this a very static analysis, which I am afraid it is?

Ms. MCCABE. Well, there is a lot in your question, Congressman.

Mr. CRAMER. Yes.

Ms. MCCABE. But on the question of stranded assets, one of the advantages to the long trajectory that the proposal has in it, which is compliance by 2030--

Mr. CRAMER. Um-hum.

Ms. MCCABE. --was exactly to address those sorts of issues. We recognize that that is a reality and we wanted have a plan that would allow States to make choices that would avoid stranded assets.

Mr. CRAMER. And I think the other advantage is that when you go that far out, nobody is going to remember that we have promised that rates were going to come down in 2030.

My time is expired.

Mr. SCHWEIKERT. Thank you.

Mr. CRAMER. Thank you for your testimony.

Mr. SCHWEIKERT. Thank you, Mr. Cramer.

Mr. Neugebauer.

Mr. NEUGEBAUER. Thank you, Mr. Chairman. Thank you for

holding this hearing.

This is a question to both of you. The EPA I think calculates that this rule will cost between $7.3 and $8.8 billion, but the U.S. Chamber of Commerce recently published a study that said they think it will cost the economy $50 billion per year through 2030. The question, you know, we have heard a lot about how high energy costs can impact businesses and that causes unemployment, but I--that thing that I think sometimes goes unsaid is, you know, what does it do to American families? So does the Administration acknowledge that if, for example, you increase the cost to a family for energy of $500 a month--a year, that what that does to low-income and senior citizens and how they are going to be able to cope with that?

Ms. MCCABE. We recognize these are real impacts. That is why the rulemaking process requires the agencies to put forward an economic analysis so everybody can take a look at those things. I will note that we need to be careful when we compare different studies to make sure that people are looking at the same thing, and so the analysis that we have in our--that is in our proposed rule now is out for public comment and people can give us their views on what the EPA is actually proposing as opposed to perhaps other ideas that people might have.

Mr. NEUGEBAUER. But you are making some assumptions

here and, you know, you have a study, they have a study, there are a lot of numbers out there. Some of those numbers that I hear are even bigger numbers than that. But the real issue is is you say by 2030 that this will be, you know, cost neutral because of energy efficiency. Well, number one, we don't know whether that efficiency will occur, but in the meantime, that little--that senior citizen or that low-income family is going to be paying more for their utilities.

Ms. MCCABE. If I may, Congressman, then I will defer to you--yes, certainly. One of the things that we did in developing this proposal was to look at the programs that are already out there and many States are very far along with very good and aggressive energy efficiency programs in which they are finding that it is good for their local economies. Utilities and utility regulatory systems are very aware of the impacts on low-income ratepayers and there are lots of programs that make sure that those impacts are mitigated or adjusted so that the benefits can be achieved without opposing those sorts of costs on people.

In this rule, which puts States in the driver's seat for deciding how they are going to implement these plans, allows them all the flexibility to make sure that they are making those kinds of sensible decisions that are sensitive to the needs of their citizens.

Mr. HOLDREN. I would like to just add two very quick

points. First of all, the Chamber of Commerce study was of what they thought the EPA plan was going to be. It was developed before the EPA plan came out and the EPA came out with a different plan than the Chamber of Commerce analyzed, so no wonder the numbers are different.

Secondly, the biggest factor in reducing coal use for electricity generation in this country has been the expansion of natural gas, and the reason that has happened, although natural gas does bring a greenhouse gas benefit, the reason it happened is that natural gas has been cheaper, not more expensive than coal.

Mr. NEUGEBAUER. Yeah. Well, again, I am not sure exactly is it--what the--if the Chamber's study would be adjusted based on the new rule, but what I have--know that we have had a number of witnesses, and sit where you are, and nobody has said that they think that this rule will make the cost of electricity go down. I mean we--and it is not just one or two people; we have had a number of people. And so I think the question that I have is that you have basically created a tax and this tax is going to be--you know, for upper income people this may not be an issue but it is going to cost, you know, jobs. But more importantly, you know, it is going to put a real strain on our families.

Speaking of jobs, what--how many--if you did an analysis and you talked about putting this rule into effect, how many

jobs do you think would be decreased by the fact that you would put this in place? Or do you think it is going to increase jobs or decrease jobs? What is your study?

Ms. MCCABE. Yeah, all of that is laid out in our Regulatory Impact Analysis and looks at the impacts in various parts of the economy on job increases and decreases. And our information shows that there will be increases in some areas and decreases in other areas. There are already those sorts of shifts going on in the energy sector, and so our analysis reflects that. So I would commend folks to take a look at that and give us their thoughts on how we have looked at those numbers.

Mr. NEUGEBAUER. What was the net?

Ms. MCCABE. If you give me a minute, I will find that for you, Congressman.

Mr. SCHWEIKERT. Ms. McCabe, can I beg of you to look that up--

Ms. MCCABE. We can get it--

Mr. SCHWEIKERT. --when it comes up, we will--

Ms. MCCABE. We will get it back to you.

Mr. SCHWEIKERT. All right.

Ms. MCCABE. We can get it back to you.

Mr. SCHWEIKERT. Thank you, Mr. Neugebauer.

Mr. Broun.

Mr. BROUN. Thank you, Mr. Chairman.

President Obama, in a nationally televised address, said his energy policies would ''necessarily skyrocket the cost of energy.'' And I think your proposed rule--and he is utilizing the EPA to do that. And I just want to make a public comment. I think this is blatantly unfair to poor people and senior citizens on limited income. That is what you guys at the OSTP in the EPA have been doing is driving up the cost of energy and it is absolutely unfair to poor people and to senior citizens on limited income, as well as the middle class. Only the rich people can afford to pay for the energy that you all's rules that you have already put in place and that you are proposing will go forward.

But why does the proposed rule that will penalize States whose utilities have decided to invest in new nuclear generation by factoring those facilities into the State targets? Shouldn't those utilities that made the decision to invest in non-emitting baseload generation get full credit for their investments? Administrator?

Ms. MCCABE. Yes. So this is an issue that we are getting a lot of input on and a lot of good discussion, and as you acknowledge, there are States and utilities that have been more forward-looking in the types of investments that they have made and we believe that the rule actually recognizes those advances and--

Mr. BROUN. Well, I don't think so and the States should

get full credit for those and the utilities that are doing so.

Also, can you discuss the treatment of the Nation's nuclear energy fleet? In your analysis you simply assume that States can keep on the nuclear power generation that they now have. How might the expected accelerated retirement of nuclear plants affect the cost of the rule?

Ms. MCCABE. Yeah, we recognize that States' choices about nuclear energy are important considerations for them. The rule itself focuses on the fossil generating fleet. That is our obligation under the Clean Air Act. We--in--we built into the rule some elements that we hope will provide some incentive to keep clean nuclear generation in operation, to help the States with their carbon intensity, and we will--we have been talking with States with significant nuclear resources to make sure that we fully understand what they see as the possible implications.

Mr. BROUN. Well, Georgia is trying to put in the first two nuclear power plants that have been authorized in several decades--

Ms. MCCABE. Right.

Mr. BROUN. --and it has run into problem after problem, Georgia Power Company has and Southern Company has because of this Administration particularly. We need to make nuclear power easier to put in place. We need to have some policy

to--NRC as well as EPA and other entities that affect these, to make it so that utilities can put in power plants and not so expensive because that is going to make electricity much cheaper and it is non-emitting.

Dr. Holdren, emails have emerged in the Richard Windsor lawsuit where EPA Administrator--former Administrator Lisa Jackson violated the law by using false email identity that also revealed that you used a private email account for work-related emails, all this while you were at the White House. According to records from that lawsuit, you were sending such work-related emails to your duties at the White House even after you send a memo admonishing other OSTP employees to stop using private email account. And in fact you even pledged that you were going to cut ties with previous groups and you used private emails, I understand, with the Woods Hole Oceanographic Institute in spite of your pledge and against the law. Have you decided to heed your own advice and stop using your private email account when you are clearly discussing your work-related duties of the White House?

Mr. HOLDREN. I am not sure what that has to do with the topic of this hearing but I will answer. The--

Mr. BROUN. You were here before me and last time I saw you we were in the office talking about another issue and hopefully we can settle that in the future.

Mr. HOLDREN. So--

Mr. BROUN. But--

Mr. HOLDREN. --the answer is I copied--

Mr. BROUN. --I think it is very important--

Mr. HOLDREN. --as the regulations require in the White House, I copied all work-related emails that originated on my home computer to the White House so that there would be a record so there would be no violation of the Federal Records Act. The reason I did some of those emails initially at home was that I didn't have the technological capability to get at my White House computer from home. We now have that capability and I am no longer using my home computer when I am not at the White House. But then I complied--

Mr. BROUN. So you utilized--

Mr. HOLDREN. I complied with regulations by copying those emails to my White House computer so that there would be no violation of the Federal Records Act.

Mr. BROUN. And so all of your private emails were put into public records so that the--

Mr. HOLDREN. As far as I know, all those related to work--

Mr. BROUN. --Federal Records Act and Freedom of Information Act, there is no violation?

Mr. HOLDREN. As far as I know, there is no violation. As far as I know, I succeeded in my intention to copy all of

my work-related emails to the White House computer.

Mr. BROUN. Well, I certainly hope so. Lisa Jackson broke the law--

Mr. HOLDREN. Okay.

Mr. BROUN. --and I think that you are doing the same thing when you do that.

Mr. SCHWEIKERT. Thank you, Mr. Broun.

Mr. BROUN. My time is expired. Thank you, Mr. Chairman.

Mr. SCHWEIKERT. Mr. Hultgren.

Mr. HULTGREN. Thank you both for being here. We as policymakers certainly need to know how science is being used by the Administration to justify new rules. Too many of my constituents are just struggling to keep the lights on, just as we were struggling earlier in this hearing, on home or work, so they really do need to know the effects the rules will actually have. To many of my constituents, many of this Administration's new regulations seem to benefit lawyers in Washington, D.C., more than the environment back in McHenry County, Illinois.

Administrator McCabe, we have had former Administration witnesses testify to EPA's interagency collaboration as being merely a box-checking exercise rather than a true collaboration. This echoed back to your response to me in a previous hearing where you would not say that EPA actually

utilized DOE's Technology Readiness Assessment for the technologies you needed to justify your own rules.

This seems to be an ongoing problem throughout your agency and with environmental regulations in general, so I want to ask a more specific question about how EPA plans to react during the potential grid reliability emergencies that I am afraid these rules might bring about. It is my understanding that there have been two instances where plants were shut down due to EPA regulations but DOE required them under Section 202(c) of the Federal Power Act to resume operations in order to avoid a reliability emergency. If these plants did not resume operation, they would face unlimited liability from lawsuits under the Clean Air Act. One of the plants did resume operation and was slapped with National Ambient Air Quality Standard violation. The other was forced to settle significant lawsuits out of court.

This should be a yes or a no. If you are receiving two conflicting orders from a regulatory agency, is it proper use of regulatory authority to just make a citizen choose which fines they pay and which mandates they ignore? This certainly seems to be a case where the EPA rules say that the lights being off is a greater benefit to society than people working. When or could the Administration's new plan be used in this way?

Ms. MCCABE. EPA works closely with DOE and with FERC

and we have been for a number of years to make sure that we are keeping on top of any potential reliability issues. The--our system of laws in this country has provisions for emergency situations that, as you note, have been activated not very often, and so we work within those system of laws.

There are a number of things about the Clean Power Plan that we think will make those sorts of situations very unlikely to happen. One of them, for example, is the fact that the compliance period, the averaging times for utilities under these rules are lengthy, and so they are--they will accommodate emergency situations of short duration because they will be able to average their operations over a long period of--

Mr. HULTGREN. But the point of my question was, you know, really of forcing citizens and private entities to choose between which fines they will pay, which mandates they ignore. Again, I feel like this is an unfair situation to put them in.

Let me address a second question to both of you. Factoring out supposedly co-benefits from other emissions, how do carbon reductions equate to reductions in heart attacks and asthma?

Mr. HOLDREN. That all has to do with the effects of climate change itself as carbon dioxide does not cause asthma by itself; it does not cause heart attacks. If, however, you

change the climate so that there are more extreme instances of heat stress, you contribute to heart attacks. If you change the climate in a manner that increases pollens or increases conventional air pollutants of a number of kinds, then you affect asthma.

Mr. HULTGREN. Administrator McCabe, is EPA considering any additional requirements for reductions in ozone?

Ms. MCCABE. They are--we have a process underway now as the Clean Air Act requires--

Mr. HULTGREN. So yes?

Ms. MCCABE. --to review the 2008 ozone standard.

Mr. HULTGREN. And what is that lowering amount that is being considered?

Ms. MCCABE. EPA has not proposed a rule yet. We will propose one later this year. There has been a science inquiry going on for the last couple of years, as is required by the Clean Air Act.

Mr. HULTGREN. Was it an agency decision to create new rules or was this a result of a lawsuit?

Ms. MCCABE. We are required under the Clean Air Act to review the National ambient air quality standards on a regular basis, every 5 years.

Mr. HULTGREN. Do you believe the EPA should have their hands tied on this if they know a rule cannot be complied with?

Ms. MCCABE. There is a premise of that sentence that I don't agree with. The EPA, ever since the beginning of the Clean Air Act, has successfully promulgated health standards for air quality that have led to tremendous improvements in public health across the country.

Mr. HULTGREN. My time is expired. I yield back the balance of my time.

Mr. SCHWEIKERT. Thank you, Mr. Hultgren.

Mr. HULTGREN. Thank you.

Mr. SCHWEIKERT. Mr. Kennedy.

Mr. KENNEDY. Thank you, Chairman.

To Ms. McCabe--thank you both, first of all. It is great to see you again. Thank you both for coming to testify today. Thank you for your service to your country.

Ms. McCabe, at a hearing on the Clean Power Plan back in July, Dr. Cash, who is the Commissioner of Massachusetts Department of Environmental Protection, highlighted the successes of RGGI, the Regional Greenhouse Gas Initiative in New England. For example, he indicated that through RGGI, the participating States have been able to reduce carbon emissions by 40 percent while simultaneously expanding the regional economy by 7 percent. It is my understanding that EPA recognizes the effectiveness of the state partnerships like RGGI and has explicitly drafted a proposed rule to allow partnerships like these to continue. I was hoping, Ms.

McCabe, that you might be able to discuss some of the advantages of using a regional approach like this to reduce carbon emissions and its impact on innovation.

Ms. MCCABE. Yeah, that is a very, very good question, and Dr. Cash is very eloquent on the benefits of the program to Massachusetts. I have had that conversation with him.

There are a number of benefits and I will just emphasize that in our proposal we are agnostic about whether States might want to join with other States but there are definitely are some advantages. One advantage is that, as you make the pool of participants larger, you increase the opportunities and that will generally lead to more opportunity for more cost-effective reductions; the bigger the pool, the more opportunity. So that is one.

There are advantages that some States may perceive because of the way the energy production system works. That is some companies operate--many companies operate in more than one State and so it can reduce complexity for there to be a regional plan that States can work within, and so that is another definite benefit.

It can simplify--the RGGI system has some very straightforward compliance mechanisms in place that simplify the operation of the program, and again, that brings cost down, brings more certainty to the process.

Mr. KENNEDY. Great, thank you. And now a question for

you both, and, Dr. Holdren, maybe you can start. It has often been said or at least reported in the press--some aspects of the press that the Administration is waging a ''war on coal.'' However, I think it is important to note that thus far the Administration has invested about $6 billion in support of developing carbon capture and other technologies to try to make coal more efficient and to reduce its environmental impacts. I believe in December of last year DOE issued a solicitation making up to $1 billion in loan guarantees available to fossil fuel projects.

Dr. Holdren, I was wondering if you could just respond to the assertion about war on coal and discuss some of the Administration's efforts?

Mr. HOLDREN. Thank you, Congressman Kennedy.

We have actually addressed that a number of times. I know you had to be out of the room but the--

Mr. KENNEDY. Apologies.

Mr. HOLDREN. --President and the Administration are certainly not waging a war on coal, far from it as you point out. We are investing billions and billions of dollars in improving coal technologies with the understanding and the expectation that coal will continue for many decades to come to play a significant role in our electricity generating system.

One of the things we noted was that under the proposed

rules coal would still be generating 30 percent of U.S. electricity in 2030. That is a lot of electricity, it is a lot of coal, but we hope to do it much more cleanly.

Mr. KENNEDY. Ms. McCabe, anything to add?

Ms. MCCABE. No, I second it.

Mr. KENNEDY. Okay. I apologize for making you repeat yourself but I appreciate the fact that you did. Thanks very much and I yield back.

Mr. SCHWEIKERT. Thank you, Mr. Kennedy.

And I am going to recognize myself.

And I would actually like to hand a couple minutes over to the good doctor, Dr. Bucshon.

Mr. BUCSHON. Thank you. I had another committee markup. We just reauthorized Amtrak over in Transportation, so my apologies for not being at the entire hearing.

But I want a couple follow-ups. First of all, Ms. McCabe, I would like to invite you to my district for a public hearing on the new--or in fact any coal-producing State, if EPA could come into a--and listen to what the people in my district or other coal-producing States have to say, I am inviting you to my district to do that.

Dr. Holdren, on the--I am going to request from you that the White House and the EPA release all of the scientific information, including all of the data justifying the premise that is being promoted--that this regulation, the new power

plant regulations will decrease the incidence of asthma and heart attacks, including all the medical background information. I have requested this before from Health and Human Services and others and they have hidden behind HIPAA regulations, but I would request that we get all that information to back up these claims.

And also, as you admitted, there is a difference between particulate emission and CO2 emission, and this hearing is primarily about CO2 emission, and I will give you that there is a significant difference. And the comments I made earlier are primarily based on particulate information but also then you can't use that and say it is justifying CO2 emission requirements.

My final comment will be carbon capture and sequestration is not economically feasible and not commercially available for my State. Therefore, putting in place a regulation that requires it to comply also isn't economically feasible for my State. I understand the science behind it. I agree that industry and all of us should always be looking for better ways to burn coal, but the time frame and the assumptions that are made for this are off base for my State and 85 percent of--80 to 85 percent of our power is from coal. We are a huge manufacturing State. We are going to lose jobs. My district has every coalmine in the State. We have already--we are closing to power plants, we have

closed one coal--two coalmines now, and I would implore you to look at that economic information.

I yield back to the Chairman.

Mr. SCHWEIKERT. Thank you, Doctor.

And forgive also the comings and goings today. This is just a chaotic moment as we are, you know, trying to finish off this week and so all the running back and forth.

I had two minutes left in my--and I will ask you to put that on the clock so we are studious in splitting the time.

It is a conversation I would like to do in much greater depth and my point of reference is actually sort of the discussion of allocation of resources, so in some ways it is less about ACO2, the, you know, PM10, some of the NOX, some of the other--it is the allocation of resources and where we maximize benefits.

Sitting in the same chairs about 2 months ago we had four researchers, all absolutely believed in the difficulties with ACO2 and the environment, but when asked the question of what you would do for the next 5, 10 years, the allocation? Is--and I was surprised at the responses. I would deal with invasive species. I would deal with the fish population and some others.

So there was a real interesting allocation question, and I have great fear that much of sort of the discussion we are having around today may be driven by those who have invested

in certain technologies and, as my father used to say, it is always about the money. Am I being--let me ask, at a high-level policy level, how much sort of moves into the discussion of are we driving the allocation of resources where we maximize benefit to our society and the environment?

And that is actually I think more of a Ms. McCabe type question.

Mr. HOLDREN. Actually, I am going to start and then I will--

Mr. SCHWEIKERT. Should I flip it because--

Mr. HOLDREN. --turn it over to Ms. McCabe. Yeah. I will flip it very quickly but allocation of course is always a big challenge. In the climate change domain the problem is that if we focus constantly on shorter-term priorities and push off the climate change steps that we need to take, it is going to be impossible to meet the 2 degree target or even the--

Mr. SCHWEIKERT. Doctor--

Mr. HOLDREN. --3 degree target--

Mr. SCHWEIKERT. --there is actually a problem in that. If you and I go back to literature that I think even you were a participant in a decade ago, none of us expected the revolution that has happened in natural gas. Who would have ever thought we would have that and exceeded the Kyoto

accords because of the long-term futures prices of natural gas? So sometimes that arrogance of knowing what tomorrow is were wrong. And I am--this is rude to do; I would love to carry this conversation on in the future--

Mr. HOLDREN. We should.

Mr. SCHWEIKERT. I am now beyond--

Mr. HOLDREN. We should.

Mr. SCHWEIKERT. --my time and I have to run to another committee, so thank you. And I am going to actually hand over Chair so our Ranking Member can do her 5 minutes. Madam Ranking Member.

Ms. JOHNSON. Thank you very much. And I have to apologize. I was one of those that had to go to another committee for a markup.

But, Dr. Holden, as you are aware, the Administration's Council of Economic Advisors released a report in July which makes the economic case for addressing climate change. The main conclusion is that delaying action is costly. In fact, the report indicates that if the lack of action results in warming of 3 degrees Celsius above the preindustrial levels rather than 2 degrees Celsius, then the increased economic damages to the United States could be as high as $150 billion annually.

Now, I am a nurse and we have talked all about how much it costs and how many jobs, but I am not sure how much we

have talked about how many lives that are affected if we don't clean this environment. In your testimony you mentioned a growing consensus among economists and others that makes a compelling case for making substantial investments to address climate change. Can you please describe the current state of the economic literature--excuse me--comparing the cost of action and inaction on climate change? Thank you.

Mr. HOLDREN. Yes, thank you very much. I do expand on that at some length in my testimony. What has been happening in the economic literature of the past two decades is an increasing trend toward a strong consensus that we need to take action and we need to take action sooner rather than later precisely because of the kinds of finding that you cited. And by the way, there are other findings out there that point to even more alarming possibilities if we allow the temperature--the global average surface temperature of the atmosphere to go to 3 degrees Celsius or higher. The likelihood of tipping points leading to truly unmanageable change, that goes up as one goes into those domains and nobody really has a handle on what the upper limit of damages might be.

Just from the standpoint of investment in prudent insurance, it makes sense to take steps now to reduce the likelihood of getting anywhere near those temperature

regimes, and economists as well as natural scientists have really largely come to agreement about that.

Ms. JOHNSON. Thank you very much. And I do thank both of you for coming and simply say that while we might sit here with our heads in the dust or whatever, the damage goes on, and it is time for us to address the issue. And I appreciate you coming, I appreciate your steadfastness, and I certainly appreciate the work of EPA. Thank you. I yield back.

Mr. BRIDENSTINE. [Presiding] The gentlelady yields back.

I am evidence that if you stay here long enough, they eventually give you the gavel.

And I would like to thank the witnesses for being here and for your testimony and for all the members who are left, which is one, for your questions. The members of the committee may have additional questions for you and we will ask you to respond to those questions in writing. The record will remain open for 2 weeks for additional comments and written questions from the members.

The witnesses are excused and the hearing is adjourned.

[Whereupon, at 12:09 p.m., the Committee was adjourned.]

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SPEAKER LISTING
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LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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WASHINGTON, DC 20515-6301

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October 17, 2014

The Honorable John P. Holdren
Director, Office of Science and Technology Policy
Executive Office of the President
725 17th Street, NW, Room 5228
Washington, DC 20502

Dear Dr. Holdren,

On behalf of the Committee on Science, Space, and Technology, I want to express my appreciation for your participation in the hearing entitled "The Administration's Climate Plan: Failure by Design" on Wednesday, September 17, 2014.

You have received a verbatim electronic transcript of the hearing for your review. The Committee's rule pertaining to the printing of transcripts is as follows:

> *The transcripts of those hearings conducted by the Committee and Subcommittees shall be published as a substantially verbatim account of remarks actually made during the proceedings, subject only to technical, grammatical, and typographical corrections authorized by the person making the remarks involved.*

Transcript edits, if any, should be submitted no later than November 7, 2014. If no edits are received by the above date, I will presume that you have no suggested edits to the transcript.

I am also enclosing questions submitted for the record by Members of the Committee. These are questions that the Members were unable to pursue during the time allotted at the hearing, but felt were important to address as part of the official record. **It would be appreciated if you would respond to these questions by November 7, 2014.**

All transcript edits and responses to the enclosed questions should be submitted to me and directed to the attention of Taylor Jordan at Taylor.Jordan@mail.house.gov. If you have any further questions or concerns, please contact Mr. Jordan at 202.225.5967.

Thank you again for your testimony.

Sincerely,

Lamar Smith
Chairman

Enclosure: Member Questions and Transcript

QUESTIONS FOR THE RECORD
The Honorable Lamar Smith (R-TX)
U.S. House Committee on Science, Space, and Technology

The Administration's Climate Plan: Failure by Design

Wednesday September 17, 2014

Questions for the Honorable John Holdren

1. The U.S. Global Change Research Program's (USGCRP) mission promotes meeting the challenges of climate and global change through the engagement and guidance of science. USGCRP's budget is comprised of funding from many federal agencies, which also conduct research in different disciplines of climate change. With a budget of over $2 billion, USGCRP conducts extensive global research.

    a. What role does the USGCRP play in developing the President's Climate Action Plan?

    b. What role does the USGCRP play in the U.N. International Panel on Climate Change or other international efforts?

    c. Did USGCRP consult with OSTP or EPA regarding the proposed regulations for power plants?

2. As the international community looks toward next year's 21st Conference of the Parties on Climate Change:

    a. What are you, or any other OSTP employees, currently doing in preparation?

    b. Which, if any countries, have pledged to the administration that they will take similarly drastic steps to reduce CO2 emissions?

    c. Please explain the President's intentions to submit any future international agreements on climate to the Senate for its Advice and Consent.

3. If the Climate Action Plan were implemented:

    a. How many jobs will be lost because of all the new regulations?

    b. How did you reach that conclusion?

4. In your recent testimony before this committee, you wrote (page 7, QFRs) that "in many cases not all the benefits and costs of a rule can be quantified and/or monetized."

    a. How does this factor into the policies that you recommend to the President?

    b. How does this statement apply to your Climate Action Plan?

5. The Like Minded Group of Developing Countries, which represents China, India, and other major developing nations, submitted a position statement to the UN Framework Convention Secretariat last fall on the negotiations for a global climate change agreement in Paris in 2015.

    The statement emphasized that the distinctions established in the 1992 Rio Convention between developing and developed countries should remain in any new agreement, and that developed countries should take the lead on reducing emissions, while any actions by developing countries would be conditioned on receiving "support from developed countries."

    In 1992, China could fairly be classified as a developing country. But today, China is a huge industrial power, one of the world's largest manufacturing nations, and the largest emitter of greenhouse gasses.

a. Does the Obama administration believe that all Paris agreements will maintain the distinctions made in 1992, and continue to treat China as a developing country, with vastly different responsibilities under the UN Framework Convention?

b. What is the nature of the "support" provided for emission reductions by developing nations? The statement references the provision of "public finance" from developed nations to developing countries – will the President make any commitments on "public finance"? Will Congress be consulted on these commitments?

c. Is it acceptable for developed nations to undertake emissions cutbacks well in advance of any reductions by developing countries? What are the international trade implications of such an approach?

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    a. Has the United States agreed to a mechanism for compensating developing nations for the impacts of extreme weather events?

b. Assuming these damages could be causally linked to global greenhouse gas emissions, how should the cost of such damages be divided among developed nations?

7. The Like Minded Group statement also references $100 billion in funding offered to developing countries in Cancun in 2010 in order to "cope with the adverse effects of global warming" post-2020, and requests increases in this amount for future efforts.

   a. Does the Obama administration support the $100 billion offer referenced in the statement?

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   a. Former EPA Deputy Administrator Bob Perciasepe noted that the EPA views the climate plan as an opportunity for the agency to remake the nation's electric grid. Is this an appropriate role for the EPA?

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10. President Obama issued a memo entitled "Transparency and Open Government" which state the following:

    "My Administration is committed to creating an unprecedented level of openness in Government. We will work together to ensure the public trust and establish a system of transparency, public participation, and collaboration. Openness will strengthen our democracy and promote efficiency and effectiveness in Government."

In February of 2014, Dr. John Graham, Dean of Public and Environmental Affairs at Indiana University and former Administrator at the Office of Management and Budget, wrote in his testimony of his support that EPA should not issue regulations unless all scientific and technical information relied upon is specifically identified. He writes:

> "A third party (or even another federal agency or OMB) cannot possibly evaluate the merits of a covered action if they do not know what specific scientific and technical information was relied upon by EPA."

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The Administration's Climate Plan: Failure by Design

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1. In response to this Committee's QFRs following your appearance on March 26, 2014, you were asked for a copy of Mr. Todd Park's (former US Chief Technology Officer) Form 278. You appeared to misunderstand the question and directed the Committee to a website to fill out an OGE Form 201. On behalf of the Committee, I reiterate the request for all of Mr. Park's financial disclosure forms during his tenure as US Chief Technology Officer.

   As a courtesy, and in response to a direct request from a Committee of jurisdiction over OSTP, I do not foresee any challenges in your being able to provide the documents requested.

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The Honorable Lamar Smith (R-TX)
U.S. House Committee on Science, Space, and Technology

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a. What role does the USGCRP play in developing the President's Climate Action Plan?

USGCRP leadership, including the Executive Director, Deputy Director, and related staff, representing the USGCRP, have participated extensively in the development of the Plan, as have affiliated members of many of the USGCRP agencies.

b. What role does the USGCRP play in the U.N. International Panel on Climate Change or other international efforts?

USGCRP is the mechanism that supports and enables the U.S. Government's review processes for the Intergovernmental Panel on Climate Change (IPCC) assessments and other international assessments. For the recent IPCC 5th Assessment, USGCRP supported each of the three Working Group reports, the Synthesis Report, and many of the related IPCC Special Report publications. In addition, USGCRP supports the cost and staffing of a significant part of the IPCC Working Group Two Technical Support Unit. USGCRP staff and member agency representatives have also been members of the United States' delegations for all of the Assessment Report 5 Working Group negotiations and the negotiations for approval of the Synthesis Report.

c. Did USGCRP consult with OSTP or EPA regarding the proposed regulations for power plants?

No.

2. As the international community looks toward next year's 21st Conference of the Parties on Climate Change:

a. What are you, or any other OSTP employees, currently doing in preparation?

I and a few members of the OSTP staff have been involved in discussions in the Executive Office of the President on options for what the United States might present at or before COP21 for this country's post-2020 emissions targets.

b. Which, if any countries, have pledged to the administration that they will take similarly drastic steps to reduce CO2 emissions?

The European Union recently announced publicly that its members collectively would reduce their emissions by 40 percent below 1990 levels by 2030.

c. Please explain the President's intentions to submit any future international agreements on climate to the Senate for its Advice and Consent.

I am not in a position to comment on the President's intentions.

3. If the Climate Action Plan were implemented:

a. How many jobs will be lost because of all the new regulations?

It stands to reason that most of the activities called for in the President's Climate Action Plan will spur economic growth that, in turn, will afford new jobs and employment opportunities. Examples of such activities include the following:

- **Promoting leadership in renewable energy, through accelerating clean-energy permitting and expanding and modernizing the electric grid.**
- **Spurring investment in advanced fossil-energy projects.**
- **Developing and deploying advanced transportation technologies.**
- **Reducing barriers to investment in energy efficiency.**
- **Expanding programs to cut energy waste in buildings through the Better Buildings Challenge.**
- **Making the Federal government a leader in consuming energy from renewable sources and pursuing greater energy efficiency.**
- **Boosting community-based resilience to climate change by encouraging the construction of safer buildings and infrastructure.**
- **Reducing wildfire risks.**
- **Negotiating global free trade in environmental goods and services, thereby opening new markets to American goods and services in this area.**

With respect to the relatively few regulations called for in the Climate Action Plan, each relevant rule, when proposed, will be accompanied by a regulatory impact analysis (RIA) that addresses employment impacts. In EPA's recently proposed Clean Power Plan, the RIA includes an analysis of employment impacts in Chapter 6. I will note that the RIA makes the excellent point that it is difficult to quantify such impacts precisely because EPA is providing so much flexibility under the proposed rule to States to determine the contours of implementation plans.

b. How did you reach that conclusion?

With respect to my statement that many of the technology-focused activities in the Climate Action Plan will spur economic growth, this conclusion is based on two firmly established conclusions from the economics literature. The first is the evidence linking innovation to environmental regulation and environmental policies more broadly. The second is a substantial body of economics research, dating back to the seminal work of Robert Solow in the 1950s, showing that the rate of economic growth of output per unit of labor input depends substantially on the rate of technological progress in the broadest sense. Dr. Solow's work establishing the theory of economic growth, including the fundamental contribution made by technological progress, was recognized by his selection for the Nobel Prize in Economic Sciences in 1987.

4. In your recent testimony before this committee, you wrote (page 7, QFRs) that "in many cases not all the benefits and costs of a rule can be quantified and/or monetized."

a. How does this factor into the policies that you recommend to the President?

In the case of policies on which I am called to advise the President, I consider both the available qualitative and quantitative information on the effect of such policies, as well as the costs of inaction on the underlying problems that the policies are intended to address.

b. How does this statement apply to your Climate Action Plan?

In the case of the President's Climate Action Plan, the report *Climate Change Impacts in the United States: The Third National Climate Assessment,* which was produced pursuant to statutory requirement, presents a compelling scientific case for the broad and growing impacts of climate change on U.S. society and the U.S. economy. In addition to this key report, the Council of Economic Advisors published a report last July entitled *The Cost of Delaying Action to Stem Climate Change,* which investigated the economic research that has been undertaken on the effects of inaction on climate change. The report found that, "Based on a leading aggregate damage estimate in the climate economics literature, a delay that results in warming of 3° Celsius above preindustrial levels, instead of 2°, could increase economic damages by approximately 0.9 percent of global output. To put this percentage in perspective, 0.9 percent of estimated 2014 U.S. Gross Domestic Product (GDP) is approximately $150 billion. The incremental cost of an additional degree of warming beyond 3° Celsius would be even greater. Moreover, these costs are not one-time, but are rather incurred year after year because of the permanent damage caused by increased climate change resulting from the delay." The report also found that "An analysis of research on the cost of delay for hitting a specified climate target (typically, a given concentration of greenhouse gases) suggests that net mitigation costs increase, on average, by approximately 40 percent for each

decade of delay. These costs of delay are higher for more aggressive climate goals: each year of delay means more CO2 emissions, so it becomes increasingly difficult, or even infeasible, to hit a climate target that is likely to yield only moderate temperature increases." These are important considerations to any discussion of public policy surrounding potential responses to climate change.

5. The Like Minded Group of Developing Countries, which represents China, India, and other major developing nations, submitted a position statement to the UN Framework Convention Secretariat last fall on the negotiations for a global climate change agreement in Paris in 2015.

   The statement emphasized that the distinctions established in the 1992 Rio Convention between developing and developed countries should remain in any new agreement, and that developed countries should take the lead on reducing emissions, while any actions by developing countries would be conditioned on receiving "support from developed countries."

   In 1992, China could fairly be classified as a developing country. But today, China is a huge industrial power, one of the world's largest manufacturing nations, and the largest emitter of greenhouse gasses.

a. Does the Obama administration believe that all Paris agreements will maintain the distinctions made in 1992, and continue to treat China as a developing country, with vastly different responsibilities under the UN Framework Convention?

   When the Obama Administration took office, one of its major objectives in international climate talks was to shift away from the Kyoto paradigm, *i.e.*, to move away from the notion that climate commitments should be based on a bifurcated system of categories from 1992, especially given that the economic and emissions profiles of major developing countries had evolved substantially. Building on the outcome of COP-15 at Copenhagen in 2009, where we secured agreement from both developed and developing countries to take on mitigation commitments, United Nations Framework Convention on Climate Change (UNFCCC) Parties agreed in 2011 to negotiate a new agreement by 2015 that would be "applicable to all."

   In terms of the agreement to be concluded in 2015, the United States has been very clear that a bifurcated agreement, particularly one based on antiquated categories, is a non-starter. The approach the Administration has put forward and that is now under discussion at the UNFCCC regarding mitigation commitments allows countries, in effect, to self-differentiate. Nationally-determined contributions take account of Parties' varying national circumstances and capabilities. We have also been clear that these commitments should not be contingent upon the provision of international finance.

b. What is the nature of the "support" provided for emission reductions by developing

nations? The statement references the provision of "public finance" from developed nations to developing countries - will the President make any commitments on "public finance"? Will Congress be consulted on these commitments?

Developed countries provide support to developing countries through three areas: technology, finance, and capacity building. In terms of finance, developed countries are collectively working to "mobilize" $100 billion in climate assistance annually by 2020 from all sources, including public and private, in the context of meaningful and transparent mitigation actions by developing countries. While it is expected that the majority of this will come from private sources, public finance represents an important lever for catalyzing private investment. In terms of the Paris agreement, the United States has opposed a collective public-finance target as well as legally-binding individual Party public-finance commitments.

Going forward, I cannot comment on what the President may do. But as with other Federal funding, any commitments or requests for Federal international assistance funding would be subject to Congressional authorization and appropriation.

c. Is it acceptable for developed nations to undertake emissions cutbacks well in advance of any reductions by developing countries? What are the international trade implications of such an approach?

The United States is committed to leading efforts to address climate change both at home and abroad. This is a top priority as reflected in the President's Climate Action Plan. By acting now, the U.S. is demonstrating leadership and driving the agenda toward a new international climate agreement that is ambitious, effective, and inclusive of all countries, particularly the largest greenhouse-gas emitters. To accomplish this goal, we advocate an approach under which all countries – both developed and developing – put forward nationally-determined mitigation contributions well in advance of the Paris conference to provide time for countries and civil society to consult before finalizing the agreement in Paris. It is important that major economies, as well as a significant number of other countries, do the same. The Administration has taken significant steps toward that goal, including significant investments to increase renewable energy production and setting standards that will double the fuel economy of our light-duty vehicles by 2025. These actions have the added benefit of spurring economic growth based on American innovation and entrepreneurship.

6. The Like Minded Group submission states that the "Loss and Damage" mechanism established in Doha in December 2012, which provides developing countries with compensation for damages from extreme weather events allegedly caused by climate change, must be made "operational and robust."

a. Has the United States agreed to a mechanism for compensating developing nations for the impacts of extreme weather events?

No, the United States has not agreed to such a compensation mechanism. No such compensation mechanism has been established. Parties did, however, establish a Loss & Damage Warsaw International Mechanism in 2013. This mechanism is not a funding facility; it does not include any mention of compensation. The mechanism, however, will seek to improve knowledge and action on issues related to comprehensive risk management and other approaches to reduce and avert loss and damage.

b. Assuming these damages could be causally linked to global greenhouse gas emissions, how should the cost of such damages be divided among developed nations?

Parties to the UNFCCC have not agreed to a compensation mechanism. Any potential allocations would have to be the subject of future negotiations before they are operationalized.

7. The Like Minded Group statement also references $100 billion in funding offered to developing countries in Cancun in 2010 in order to "cope with the adverse effects of global warming" post-2020, and requests increases in this amount for future efforts.

a. Does the Obama administration support the $100 billion offer referenced in the statement?

The $100 billion commitment undertaken by the United States and other donor countries at Copenhagen in 2009 was to "mobilize" $100 billion in climate assistance annually by 2020 from all sources, including public and private, in the context of meaningful and transparent mitigation actions by developing countries. The United States has worked with other donors toward mobilizing finance from across the spectrum, with a focus on how to most effectively use our public resources to unlock private investment. Collectively, developed countries have made significant progress with public finance alone, amounting to $30-50 billion in 2013. Demonstrating progress towards the $100 billion goal is key to maintaining U.S. leadership and keeping the UNFCCC negotiations on track.

b. Which nations would contribute to this amount? How would this amount be increased to meet the "real financing needs of developing countries"?

The United States is now working with other developed countries to collectively mobilize $100 billion per year by 2020 from all sources, public and private, in the context of meaningful and transparent mitigation by developing countries. We are coordinating with other donor countries to

bring together development finance institutions, export credit agencies, and multilateral development banks on this issue.

We continue to hear large, and in our view excessive, demands by developing countries for new public finance commitments by developed countries in conjunction with the Paris agreement. We have pushed back against these demands. Any finance commitments made in connection with the 2015 agreement will need to reflect our fiscal realities and include an expanded pool of contributors.

c. What role does the Obama administration see for Congress in approving this financing?

As with other Federal funding for international assistance, future budget requests, if any, would be subject to Congressional authorization and appropriation.

8. Our grid, from generation to consumption, was built on technologies that took more than 100 years to establish. And yet the "Clean Power Plan" seeks to fundamentally re-engineer the grid and the electricity that provides power for consumers and businesses by 2030.

   a. Former EPA Deputy Administrator Bob Perciasepe noted that the EPA views the climate plan as an opportunity for the agency to remake the nation's electric grid. Is this an appropriate role for the EPA?

   I would refer any questions you may have about EPA's role in the Clean Power Plan to my EPA co-panelist at the hearing.

   b. What is the legal authority for EPA to remake the nation's electric grid?

   Again, I would refer any questions you may have about EPA's role in the Clean Power Plan to my EPA co-panelist at the hearing.

9. In your written response to a question: "In the peer review process, are peer reviewers always provided access to the underlying and raw data behind a study?" you explain that (page 4) "peer reviewers are not always provided access to the full underlying and raw data behind a study."

   Are there any instances where limited data access may mask mistakes or biases in the analysis, or any other part of the scientific process of the study?

   As with all human endeavor, there will be such instances, but this possibility is addressed under the broader concept of reproducibility that I explained in my previous response, namely that: "In the scientific community, [reproducibility]

does not necessarily imply access to the original raw data from another researcher, but rather that further experimentation either using similar methods or an alternative approach can reproduce the results of the initial study, leading to independent confirmation and weight-of-evidence support to a concept."

10. President Obama issued a memo entitled "Transparency and Open Government" which state the following:

"My Administration is committed to creating an unprecedented level of openness in Government. We will work together to ensure the public trust and establish a system of transparency, public participation, and collaboration. Openness will strengthen our democracy and promote efficiency and effectiveness in Government."

In February of 2014, Dr. John Graham, Dean of Public and Environmental Affairs at Indiana University and former Administrator at the Office of Management and Budget, wrote in his testimony of his support that EPA should not issue regulations unless all scientific and technical information relied upon is specifically identified. He writes:

"A third party (or even another federal agency or OMB) cannot possibly evaluate the merits of a covered action if they do not know what specific scientific and technical information was relied upon by EPA."

a. Do you support the principle of scientific transparency?

Yes.

b. What specific recommendations would you make to the EPA so that this scientific and technical information is available to any interested party who requests this information?

Interested researchers should have access to Federally-funded publications and research data to the greatest extent and with the fewest constraints possible, taking into consideration privacy, confidentiality, and security risks. The Executive Office of the President has issued extensive guidance on this topic, including: OMB's *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (78 FR 78589) to implement the Shelby Amendment to Public Law 105-277; OMB's Government-wide *Information Quality Guidelines* and those of the EPA; OMB's Circular A-4; and more recently and expansively my December 2010 memorandum on Scientific Integrity (http://www.whitehouse.gov/sites/default/files/microsites/ostp/scientific-integrity-memo-12172010.pdf) and my February 2013 memorandum on *Increasing Access to the Results of Federally Funded Scientific Research* (http://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf). The latter is one of the foundations of the President's Open Data Policy requirements under the May 9, 2013 Executive Order – *Making Open and Machine Readable the New Default for Government Information*. The overarching intent of these actions is to make Federally-funded publications and research data

openly available "to the greatest extent and with the fewest constraints possible."

Dr. Graham goes on to state in his written testimony regarding original health data from epidemiological studies that: "If the underlying data from the key health studies were made publicly available for all researchers to analyze (rather than just a select few appointed by Health Effects Institute), I think it is quite possible that many new insights would be gleaned and some of the conventional wisdoms we now accept as fact would be dislodged or refined."

c. Is Dr. Graham correct in this statement?

The Health Effects Institute (HEI) is a highly respected research institution jointly funded by the EPA and industry. The original studies based on the American Cancer Society and Harvard University cohorts already have been subject to reanalysis and validation by HEI. Specifically, HEI entered into confidentiality agreements with the owners of the data to have access to the data in order to conduct a reanalysis of two studies of these cohorts. That re-analysis took 30 researchers more than three years to complete, and confirmed the validity of the findings and methodology. The same methodological approaches were used in the more recent studies of these cohorts, and are therefore similarly validated by the HEI reanalysis.

d. Why shouldn't any interested researcher have access to this data?

Interested researchers should have access to Federally-funded publications and research data to the greatest extent and with the fewest constraints possible, taking into consideration privacy, confidentiality, and security risks.

QUESTIONS FOR THE RECORD
The Honorable Paul Broun (R-GA)
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   The U.S. Office of Government Ethics has confirmed that--consistent with Section 105 of the Ethics in Government Act of 1978, as amended (5 U.S.C. App.), and 5 C.F.R § 2634.603--any requestor, including a Member of Congress, is required to submit the OGE Form 201 to request such records. The OGE Form 201 is available online at http://oge.gov/Forms-Library/OGE-Form-201--Request-to-Inspect-or-Receive-Copies-of-OGE-Form-278/SF-278s-or-Other-Covered-Records/. OSTP will process your request expeditiously upon receipt of this required form.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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October 17, 2014

Janet McCabe
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N. W.
Washington, DC 20460

Dear Ms. McCabe,

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I am also enclosing questions submitted for the record by Members of the Committee. These are questions that the Members were unable to pursue during the time allotted at the hearing, but felt were important to address as part of the official record. **It would be appreciated if you would respond to these questions by November 7, 2014.**

All transcript edits and responses to the enclosed questions should be submitted to me and directed to the attention of Taylor Jordan at Taylor.Jordan@mail.house.gov. If you have any further questions or concerns, please contact Mr. Jordan at 202.225.5967.

Thank you again for your testimony.

Sincerely,

Lamar Smith
Chairman

Enclosure: Member Questions and Transcript

QUESTIONS FOR THE RECORD
The Honorable Lamar Smith (R-TX)
U.S. House Committee on Science, Space, and Technology

The Administration's Climate Plan: Failure by Design

Wednesday September 17, 2014

Questions for Ms. McCabe

1. EPA has claimed that the "Clean Power Plan" will reduce asthma and heart attacks because it will reduce ozone and emissions of particulate matter. However, ozone and particulate matter are heavily regulated under separate environmental regulations. Factoring out those other emissions, how do carbon dioxide reductions equate to reductions in heart attacks and asthma?

2. How much flexibility do state regulators have in determining the final emission rate in each of the states?

3. What particular section(s) in the Clean Air Act authorizes the EPA to eliminate or constrict the use of a particular fuel for electricity?

4. As the international community looks toward next year's 21st Conference of the Parties on Climate Change:

    a. What is EPA, any EPA regional offices, or any employees, currently doing in preparation?

    b. Please detail any Clean Air Act authorities or other roles EPA has to play a role in these negotiations.

    c. Which, if any countries, have pledged to the administration that they will take similarly drastic steps to reduce CO2 emissions?

    d. Will EPA encourage the President to submit any future international agreements or treaties on climate to the Senate for its Advice and Consent?

5. Regardless of whether EPA will -- or will not -- release a "model FIP," please answer the following questions:

   a. Does EPA have authority under section 111(d) (or any other section of the CAA) to issue a mandatory federal plan that orders a state to dispatch low-carbon electricity? Please prove all supporting legal precedents and authorities.

   b. Does EPA have authority under section 111(d) (or any other section of the CAA) to issue a mandatory federal plan that orders a state to generate electricity from renewable sources? Please prove all supporting legal precedents and authorities.

   c. Does EPA have the authority under section 111(d) (or any other section of the CAA) to issue a mandatory federal plan that orders a state to enact consumer energy efficiency standards? Please prove all supporting legal precedents and authorities.

   d. Does EPA have the authority under section 111(d) (or any other section of the CAA) to issue a mandatory federal plan that requires a nuclear power plant to remain open? Please prove all supporting legal precedents and authorities.

6. The Clean Power Plant proposal for existing coal and natural gas fired power plants is unique in that it assumes EPA authority to regulate the structure of the electric utility system rather than pollution that comes out of a stack. There are many cases where the courts have affirmed that only the Federal Energy Regulatory Commission (FERC) may regulate the transmission and sale of electricity.

   Do you believe EPA has this new-found authority? Please prove all supporting legal precedents and authorities.

7. In an August 1, 2011 letter to Senator Lisa Murkowski, FERC Commissioner Moeller explained that the ICF model used by EPA to assess the rule's impacts on reliability is insufficient and that a transmission requirements study would be needed to develop a transmission expansion plan for the potential generation mix that may result from the ICF model.

   How do you respond to the noted deficiencies in the ICF model that EPA relies on?

8. Even though OMB is still in the process of reviewing public comments that were filed in February, EPA relies upon the global "Social Cost of Carbon" calculations to justify the Clean Power Plan. The SCC uses three Integrated Assessment Models that claim to be able to model global impacts for 300 years.

   a. What are the estimates for US-only impacts from each of the three SCC models?

b. Did EPA compare the three SCC model predicted sea levels and temperatures with MAGICC results?

c. What is the impact of the proposed reductions in CO2 emissions from US power plants on the SCC?

d. What is the impact of the increases in total non-US greenhouse gas (GHG) emissions from all sources on the SCC?

9. EPA has a model that has been used to estimate the impacts of proposed rules on global sea levels and global temperatures. This is a standard tool that appears on its official public website.

   This is the Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC) that uses the same IPCC climate models that used in the Social Cost of Carbon Integrated Assessment Models.

   a. Did EPA run a baseline case using MAGICC through 2040 to determine the sea level rise as a result of a baseline reference forecast US and global GHG emissions? Why or why not.

   b. What is the EPA MAGICC-predicted impact of the proposed REDUCTIONS in CO2-only emissions from US power plants on global sea level rise?

   c. What is the EPA MAGICC-predicted impact of the INCREASES in total greenhouse gas (GHG) emissions from all sources on global sea level rise?

Attachment D

Standard Setting Technical Problems

Building Block 1

1. EPA is unclear in how Combined Heat and Power (CHP) facilities are treated. Why didn't EPA provide clarity?
    - When is a CHP facility considered "covered"? If this is determined by sales criteria, at what date is the determination made? Can this determination change? If so, under what criteria?
    - Under what criteria can states utilize CHP for compliance purposes?

2. "Building Block" (BB) 1 fails to account for the fact that reduced utilization of coal-fired EGUs (due to BBs 2, 3, & 4) will increase heat rates, undercutting the potential for hear rate improvements (HRI) assumed technically feasible in BB 1.
    - How was reduced utilization at these facilities factored into technical feasibility?
    - Why wasn't reduced utilization factored into cost calculations?

3. Efficiency improvements generally degrade over time. Why is BB 1 based on the immediate payoffs of heat rate improvements, instead of accounting for gradual degradation?

4. Why didn't EPA undertake analysis to quantify heat rate improvements already undertaken by coal-fired EGUs?
    - How is a target achievable if it asks units to duplicate reductions that it has already achieved?
    - Why didn't EPA study heat rate improvements previously undertaken to assess degradation?

5. On p. 2-32 of the Greenhouse Gas Abatement Measures Technical Support Document (GHG TSD), EPA identified 16 units with 3-8% HRI.
    - These 16 were out of how many?
    - Over how many years?
    - Please provide the details of this analysis and record of peer-review.

6. Many units will be required to install additional environmental controls under other regulations (MATS, NSR, 316b, etc.). These controls generally increase a unit's net heat rate and therefore its net CO_2 emission rate.
    - Why didn't EPA account for this?
    - Other units simply retire. Why didn't EPA account for the changing profile of the coal fleet from 2012 forward when setting state goals?
    - Why didn't EPA analyze the non-air impacts of heat rate improvements such as changing cooling systems as mentioned on p. 2-5 of the GHG TSD?

7. Topic 2.3 on pp. 2-5 to 2-10 of the GHG TSD summarizes individual opportunities for HRI.
    - Why didn't EPA provide: citations; methodologies for the estimates; degradation estimates; or an analysis of what combinations are possible?
    - Why didn't the EPA use net output instead of gross output?

8. Other than EPA's rudimentary statistical analysis (4%) and the 2009 Sargent & Lundy (S&L) report (2%), why didn't EPA explain how the other studies cited were used to develop or support the 6% HRI target?

9. Specifically, on pp. 2-13 to 2-15 of the GHG TSD several studies are noted:

    NETL—Reducing CO2—2008

    NETL—Improving the Efficiency—2010a

    Lehigh—Reducing HR—2009

    RFF—Regulating GHG—2013

    NRDC—Closing the Power—2013

    - Why didn't EPA describe the methodology for selecting these studies as representative?
    - Why didn't EPA ensure adequate peer-review details?
    - What other studies were considered, but not included?
    - How were additional studies not detailed in this section but included in the bibliography factored in?

10. To assess the impact of capacity factor and ambient temperature on heat rate, EPA performed regression analyses for "each unit year."

    - How did EPA select this methodology?
    - Why didn't EPA calculate a separate regression for each unit, for each year from 2002 to 2012?
    - Why didn't EPA have this statistical analysis peer–reviewed?

11. In the GHG TSD, EPA assumes that a 4% heat rate improvement is available by reducing unit heat rate variability through use of "best operating practices."

    - Why did EPA conclude that variability in reported heat rate from units is the result of unit operations, and rule out other factors (besides capacity factor and ambient temperature)?
    - What expert authorities did EPA consult with to arrive at such a conclusion?

12. On p. 2-21 of the GHG TSD, EPA says only 4% of EGUs in the study were load following.

    - Why didn't EPA analyze how this will change under the application of all BBs collectively?

13. EPA derives the 4% HRI by sorting data from each unit into "bins," finds the 10th percentile value in each bin, and reduces all of the other values in the bin by a set percentage (10, 20, 30, 40, 50) of the difference between that value and the 10th percentile value.

    - What was EPA's technical basis for selecting these percentage reductions?
    - Do these represent the use of specific HRI measures?

14. Why did EPA base its estimate of achievable improvements through "best practices" on the 30% reduction option as opposed to the others? What was the technical basis for this choice?

15. EPA identifies several "no-cost and low-cost options" from the S&L report that it classifies as "best practices." There are several key questions EPA did not answer:

    - Do some or all of these measures reduce heat rate *variability*, or just overall heat rate?
    - If some reduce variability, which ones?
    - For those that do not reduce variability, do they support a claim that improvements of 4% are available through reducing variability?
    - Why didn't EPA consider degradation as a variability factor?

16. On p. 2-32 of the GHG TSD, EPA identified modifications at 3 plants collectively achieving 0.25% to 3.5% HRI.
    - Why didn't EPA provide more details or consider a great sample size?

      Over how many years was this sample taken?
    - What was the fleet average HRI when including all Region 7 coal-fired EGUs?
    - How did EPA ensure these units were representative of the fleet as a whole?
    - What other real-world HRI implementation experience did EPA solicit and consider?

17. On pp. 2-32 to 2-33 of the GHG TSD, EPA cites a WEPCO two-phase efficiency program.
    - How did EPA determine that this program was representative of HRI technically feasible today?
    - Why didn't EPA provide any follow up assessment of degradation of these HRI?
    - What peer-review did this study undergo?

18. EPA identifies the average capacity factor over the 11 year study population as 67% (p.2-23).
    - Why didn't EPA provide the projected average capacity factor after the application of all BBs?
    - Why was a 78% capacity factor used for the economic analysis? (p.2-37)

19. On pp. 2-23 to 2-24 of the GHG TSD, why does Fig 2-3 use 2012 monthly capacity factor, but then compare it with the 30 year climate normal and not the 2012 data?
    - Is this for one specific unit at BWI?
    - How does this compare with the regression analysis in 2.5.5.1?
    - Why was a twenty-two mile average distance (p. 2-19) considered a good approximation? What was the methodology EPA used to make this determination?

20. What sensitivity analysis did EPA run on the inputs referenced on p. 2-39 of the GHG TSD?

Building Block 2

1. In 2012, the Natural Gas Combined Cycle (NGCC) fleet capacity factor was 44-46%. How did EPA determine that 70% utilization was the "best system of emission reduction"?
    - What was the technical basis for this determination?
    - What literature did EPA rely on and what additional analysis did EPA perform?
    - Why didn't EPA rely on peer-reviewed data?
    - Why is 70% a "reasonable ceiling"? *See GHG TSD p.3-11.*
    - What is the physical maximum technically feasible utilization rate given hourly variability patterns? *See GHG TSD p. 3-15.*

2. Why didn't EPA account for reliability services provided by coal and oil units when determining BB 2's 70% re-dispatch requirement? Why didn't EPA consult FERC on this issue?

3. In integrating BB 2 into specific state goals, EPA only increased NGCC utilization as much as it could displace coal. This makes sense.
    - However, why didn't EPA look at coal generations numbers after all other BBs were applied?
    - Why didn't EPA make any attempt to exclude NGCC units with low capacity factors, which would be exempt from 111(d) state plans under the proposed applicability language?
    - If EPA is expanding the applicability criteria for the 111(d) rule, why didn't EPA explain how this impacts the applicability of the 111(b) NSPS for new and modified/reconstructed sources?

4. What is EPA's basis for assuming that NGCC units that are "under construction" can allocate 15% of their capacity to displace coal generation?

5. Table 3-4 of the GHG TSD does not demonstrate the ability for capacity factor growth to facilitate generation growth, but rather name plate capacity growth to facilitate generation growth.

6. Why doesn't EPA's analysis account for permit limits on NGCC units that limit ramping up operations?
    - If EPA corrects this error, will this change be made prior to finalization and reflected in reduced state goals with adequate time for comment?

7. In integrating BB 2 into state goals, why did EPA treat units that were in outages for 11 months of the year, but operated at 100% capacity for the 12th month, the same way that it treated units that operated for a full year at a 8.3% (i.e., 1/12) annual capacity factor?

8. Why did EPA determine that the top 10% of NGCC units, operating at a 70% capacity factor, was technically feasible for the entire fleet.
    - What were the characteristics of this top 10%?
    - How did EPA determine that the top 10% is representative of the entire fleet?

9. EPA justifies its 70% capacity factor target in part by stating that national average capacity factors are relatively high during hours of peak demand. In the preamble EPA states that average capacity factor is "60% or higher" during peak hours of the day, but in the TSD, EPA states that average capacity factor is only "approximately 50%" during peak hours.
    - Which is correct?

10. What technical analysis did EPA undertake to justify its assumption that existing gas pipeline infrastructure will expand by a sufficient amount to accommodate BB 2?
    - Based on what analysis does EPA believe this expansion will occur by 2020?
    - What did EPA estimate the cost of necessary pipeline expansions would be? What was the technical basis for this calculation?
    - What pipeline expertise or authorities did EPA rely on for making these determinations?
    - What was the methodology for determining what authorities to rely on? Were all authorities peer-reviewed?

11. Table 3-5 of the GHG TSD details "net capacity." However, utilization rates do not equate with unreserved capacity on a long-term basis.
    - What line packing considerations did EPA take into account?
    - Why didn't EPA analyze the integration of storage capacity? How might this further impact cost and reliability factors?
    - Why didn't EPA analyze how Dodd-frank has and will impact capacity elasticity?
    - Why didn't EPA analyze with system peak-day usage rates?

12. Why didn't EPA consider how extreme events and seasonal changes in demand for natural gas influence gas prices and availability?

13. Why didn't EPA consider the impact of expanded natural gas exports on natural gas prices?

14. In many states, as coal-fired units are ramped down, the communities they formerly served will need new transmission connections to NGCC units elsewhere.
    - Why didn't EPA consider the additional electric transmission infrastructure required?

15. Why didn't EPA account for the fact that capacity from NGCC units in one state may already be committed to other states through firm contracts (and consequently unavailable for redispatch within a state)?

16. EPA's parsed IPM results for 2025 indicate that many NGCC units do not retire, but are projected to have zero generation.
    - How is this different from retirement?
    - Why are these units not modeled as retiring?

17. EPA's cost analysis for BB 2 modeled increasing NGCC capacity factor to 70% nationwide.
    - Why didn't EPA perform modeling to assess the cost of re-dispatching NGCC to 70% capacity factor at the state level?
    - Why does EPA believe the costs in its GHG TSD accurately reflect the cost of re-dispatching NGCC to 70% capacity factor at the state level?

18. Does the IPM model have the ability to restrict re-dispatch modeling to the same owners?

19. EPA believes $34 dollar/ton cost is reasonable.
    - What was the methodology for making this determination?
    - What is the distinction between $/tonne and $/tonne CO2? Why is that the most relevant metric? *See GHG TSD 3-23.*

20. EPA projects a 10% increase in NG prices, then says EIA averages year-to-year changes at Henry Hub from 1981-2012 as 18.5%. *See GHG TSD 3-26.* EPA projection less than historic changes.
    - Why isn't the 10% *in addition to* the 18.5%?

21. EPA provides estimated increases in NG prices in national average delivered. Why didn't EPA provide state & regional estimates?

Building Block 3

1. How did EPA come up with the methodology for this approach?

2. What was the methodology for ensuring compliance with the Data Quality act?

3. Regional Renewable Energy (RE) goals are based on the average 2020 RPS goals for states within those regions.
    - How did EPA account for the fact that many of these state RPS goals include existing hydropower and credit for energy efficiency measures?
    - (Existing hydropower does not appear to count toward compliance with state goals, and energy efficiency is already accounted for in Building Block 4.)

4. Since EPA did not remove out-of-state renewables from the state RPS goals used to calculate regional RE goals, will EPA allow the use of renewable energy credits for 111(d) compliance?

5. Many states have less stringent RPS goals for co-ops and municipal utilities, but EPA only applied the more stringent primary RPS goals for these states.
    - Why does EPA claim that doing so is "inherently conservative"?
    - Doesn't this make the state goals more stringent?

6. Why did EPA assume that states begin ramping up the actual use of RE generation in 2017, when the compliance period does not begin until 2020?
    - Many states may not have even submitted plans by 2017. How did EPA account for this in setting state goals?
    - Why didn't EPA analyze the time it takes to build new RE, including citing, permitting, financing, and other factors?

7. What was EPA's feasibility analysis for annual RE growth rates for each region?

8. On p. 4-9, FN 108 of the GHG TSD, EPA states that it "did not include targets that were capacity-based." What was the technical basis for this determination?

9. For example, the regional renewable component for all Southeastern states is based on the legislatively adopted renewable requirements of one state—North Carolina.
    - Why weren't the other states in the region averaged in as "zeros"?
    - What was the technical basis for this methodology? Was it peer-reviewed?

10. The North Carolina RPS includes a number of modifying features that would <u>not</u> be part of the renewable requirement for the southeastern states in the proposed rule. For example:
        - *Cost caps for retail, commercial and industrial customers.*
        - *NC also includes energy efficiency, demand reduction and the ability to buy renewable energy certificates (RECs) <u>as components of</u> its 10% requirement – all features that would reduce the absolute costs and stringency of the portfolio standard.*
        - *NC REPS directs the state PUC to develop a procedure for modifying or delaying provisions if the Commission determines that it is in the public interest to do so. Why isn't there a similar feature in EPA's proposed rule?*
        - *Finally, there are no penalties if the N.C. targets are not met.*
    - Why did EPA ignore these features of state plans?

11. Does EPA intend to pursue the Alternative Renewable Energy Approach for calculating state RE targets? How will that decision be made?

12. In the Alternative RE Approach, EPA suggests that a state's goal would be the lesser of a GIS-based estimate of RE potential or an IPM run of RE deployment that assumes reduced costs for new renewable builds.
    - The GIS-based approach would tie each state's RE goal to the "average development rate of the top third (16) of states." What is EPA's technical basis for assuming that all states can deploy their potential RE resources to the same extent as the top 16 states?

    - The IPM-based approach would model reduced costs for developing new RE sources based on "the avoided cost of other actions that could be taken instead to reduce power sector CO_2." What does this mean? How would this approach accurately estimate a state's potential for cost-effective RE generation?

13. Alternative RE approach:

- Please detail the peer-review each study underwent.
- Why was bio-mass and landfill RE excluded?
- What modeling "reduced costs"? Was this based on the PTC? LOCE?
- Geothermal—why were the top 5, and not top 16 states considered in this portion? What changed in the methodology? Why didn't EPA consider non-air impacts?
- EPA explains that because NREL used "feasibility criteria" there is a totally different process for analysis. However, the study cited does not even look at economics. What was the technical basis for this radically different approach?
- What was the technical basis for the EPA's analysis for Alaska and Hawaii?
- Why didn't EPA apply the limiting methodology used in BB2?

Building Block 4

1. Why did EPA assume in BB 4 that states begin implementing energy efficiency (EE) measures in 2017, when the compliance period does not begin until 2020? Many states may not have even submitted plans by 2017.

2. What is the technical basis for assuming that all states can replicate the incremental annual savings achieved by Arizona, Maine, and Vermont?

3. What is the technical basis for assuming that states can sustainably achieve incremental annual savings of 1.5% every year until 2030?
    - What studies did EPA rely on to make this determination? What level of peer-review did they undergo?
    - Why didn't EPA's analysis factor in the finite nature of EE opportunities?
    - What's the upper limit for EE? What does the performance/cost curve look like?

4. EPA's IPM analysis imposes BB 4 into the model exogenously.
    - What was the technical basis for this decision?
    - Why didn't EPA model BB 4 as a variable compliance method in the IPM runs, that states could implement more or less depending on cost?
    - How can EPA be sure the IPM results accurately reflect the technical and economic feasibility when it simply assumes that BB 4 is fully implemented?
    - How can reliability be realistically assessed absent BB4 modeling that realistically examines whether other measures may be more cost-effective/chosen by states?

5. Why didn't EPA apply demand-reduction assumptions to the Base Case as well as the policy scenarios?

Rate to Mass Conversion

1. A state should be able to use EPA's IPM base case for 2020 and 2030 to convert its rate into a mass-based standard. However, a state would need the "parsed" files to do so. Why didn't EPA run all the parsed files necessary for States to estimate their mass-based standards?

Attachment E

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

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August 13, 2014

The Honorable Gina McCarthy
Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20004

Dear Administrator McCarthy,

For too long the Environmental Protection Agency (EPA) has hidden the truth from the American people. In order to regain public trust, the agency should rely on robust, objective, and well-grounded technical analysis of climate regulations. The EPA has performed limited analysis of its proposed Emissions Guidelines for Greenhouse Gas Emissions from Existing Stationary Sources: Electric Utility Generating Units. However, EPA's modeling suffers from a number of deficiencies that mask the rule's implications and limit its usefulness as a policy tool.

Setting aside key legal problems with EPA's novel approach to setting standards under section 111 of the Clean Air Act,[1] rigorous analysis through an open and transparent framework cannot be sacrificed in the name of expediency. Reassurances of "flexibility" are inadequate when considering regulations of this magnitude. Americans deserve an opportunity to see the facts.

Flaws in recent EPA analyses amplify concerns about the real impacts of these regulations. Last week the Government Accountability Office released a report highlighting a pattern of shoddy EPA analysis. It was revealed that EPA relied on decades old data and ignored important factors. The independent watchdog warned that "EPA cannot ensure that it's [analysis] provide the public with a clear understanding of its decision making."[2]

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[1] This letter and the modeling discussed herein do not address underlying problems with the legality and troubling one-size-fits-all approach to standard setting espoused in EPA's carbon guidelines. This modeling request focuses on compliance impacts. Nonetheless, I directed my staff to meet with your staff and review EPA modeling in detail: both standard setting modeling and compliance modeling. While your staff has been responsive in many regards, it is my understanding that you continue to delay this request. I respectfully ask you make the relevant staff available to facilitate these related discussions immediately.

[2] GAO, *EPA Should Improve Adherence to Guidance for Selected Elements of Regulatory Impact Analysis*, at 32 July 2014. *Available at* http://oversight.house.gov/wp-content/uploads/2014/08/GAOreport.pdf.

For example, EPA claimed that the Mercury and Air Toxics Standards (MATS) would retire just 4.7 gigawatts of power. Yet, the Energy Information Administration (EIA) now projects that 54 gigawatts of generating capacity, ten times more than EPA's projections, will close by the MATS compliance deadline.[3] EPA also said that MATS would increase electricity rates by just 1.3% to 6.3%. However, reports indicate that rate-payers are facing a 21% increase in rates this summer due to MATS power plant closures.[4] Further, EPA assured Americans that MATS would not result in reliability concerns, but Midwest grid operators now warn of an impending electricity shortage.[5]

EPA's failure to adequately model MATS impacts is all the more troubling in light of the fact that EPA itself now models up to 49 gigawatts of plant closures due to the proposed section 111 regulations. If past performance is an indication, could this number double, triple, or worse? Without public access to all underlying assumptions, modeling mechanisms, and results, it is impossible to know whether the Agency has corrected the core deficiencies that resulted in the gross underestimation of impacts. Americans cannot afford to pay for EPA's mistakes.

The Agency should provide an analysis that takes real-world contingencies into account. Although Congress is currently acting on legislation that would prohibit EPA's use of non-transparent methodologies in the development of its rules,[6] EPA continues to rely on models that are not publicly available.[7] Consequently, we are simultaneously asking the EIA to independently model the same specifications. Tandem analysis by EPA and EIA will allow for a side-by-side comparison results and provide a more comprehensive accounting of the possible impacts of the agency's proposal.

EPA's incomplete modeling disregards a number of technical, regulatory, and economic realities.[8] These omissions have the effect of downplaying the possible energy and economic impacts of this proposal while simultaneously ignoring the lack of climate benefits. The costs of any greenhouse gas policies are directly proportional to the price and availability of viable technologies. In the case of base load power, these options include carbon capture and storage (CCS), natural gas, nuclear, and hydro-electric in some locations. In its analysis, the EPA assumes that these technologies are available and relatively affordable throughout the lifetime of the policy and beyond. But the facts paint a different picture.

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[3] Energy Information Administration, *AEO2014 Projects More Coal-Fired Power Plan Retirements Than Have Been Scheduled*, Feb. 14, 2014.

[4] Julie Wernau, *Higher Electric Bill to Jolt Chicago Area*, CHI. TRIB. May 8, 2014.

[5] Midcontinent Independent Systems Operator, *OMS/MISO Resource Adequacy Survey Update* 3, Jan. 31, 2014.

[6] H.R. 4012, The Secret Science Reform Act of 2014, requires that the EPA base its regulations and assessments on science that is publicly available in a manner sufficient for independent analysis and scientific replication. Legislation and Status *available at:* http://thomas.loc.gov/cgi-bin/bdquery/z?d113:h.r.04012:. Senator Barrasso introduced a Senate companion bill, S. 2613, on July 16, 2014.

[7] EPA relies on a proprietary model, the Integrated Planning Model (IPM), whose results cannot be verified independently. The reliance on proprietary models by EPA potentially violates the Data Quality Act.

[8] This proposal will have ripple effects throughout the wider economy as higher electricity and natural gas prices create drag on other sectors. No rule should proceed absent peer-reviewed economy-wide modeling. However, EPA has not attempted to model these impacts but is establishing a "Science Advisory Board panel on economy-wide modeling to consider the technical merits and challenges of using this analytical tool to evaluate costs, benefits, and economic impacts in regulatory development." RIA at 5-2.

For example, notwithstanding the Administration's claim that CCS is "adequately demonstrated," serious questions remain about its technological and economic viability beyond unique applications. At the same time, the EPA is poised to choke off the only economically viable CCS option, enhanced oil recovery, by putting in place regulations that would preclude its use as a carbon abatement option.[9] Furthermore, EPA has refused to recognize the use of other carbon utilization technologies for compliance purposes.[10] There is no evidence that EPA's modeling has taken these considerations into account.

In addition to issues related to the use of coal, concern about climate change has reinforced opposition in some quarters against other types of energy production. In the case of natural gas, continued access at today's historically low prices is questionable in the face of special-interest opposition to drilling and the specter of additional federal regulations. Further, EPA's sweeping assumption that natural gas plants can increase annual utilization to 70% across the entire fleet, presents huge technological challenges both at the plants and within the supply chain. EPA's proposal admits that 70% utilization rates have been exceptionally rare;[11] consequently, assertions of technical feasibility require detailed modeling, contingency planning, and real-world testing. There is no evidence that EPA's modeling has taken many of these and other confounding factors into account.

Over the past decade, there has been a renewed interest in nuclear power as an alternative to fossil fuels. Yet despite greater acceptance of this emissions-free energy resource, nuclear power faces a host of obstacles and uncertainties that could not only inhibit its expansion, but will accelerate retirements from the existing fleet. EPA's modeling fails to adequately consider the challenges facing our existing nuclear fleet.

The Agency also fails to model the significant uncertainty presented by challenges to the rule. For example, a recent Supreme Court decision underscored the possibility of successful legal challenges, particularly with respect to EPA's "beyond the fence" analysis.[12] EPA claims the various "building blocks" that form the basis of its proposal are severable – meaning the rule could stand, but one or more of the various emissions reductions strategies upon which it is based could be eliminated. There is also considerable uncertainty as to whether states will embrace EPA's proposal and implement it through a State Implementation Plan (SIP) like process. Consequently, if the Agency forcibly imposes a federal implementation plan on states, EPA's options may be limited to regulating the power plants themselves. Accordingly, an alternative policy analysis should assess the impact of the guidelines under a scenario limited to heat rate improvements and dispatch changes among affected power plants.

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[9] *See generally* Letter from U.S. House of Representatives Committee on Science, Space, and Technology to EPA Administrator Gina McCarthy, Dec. 19, 2013. *Available at* http://science.house.gov/sites/republicans.science.house.gov/files/documents/Letters/121913_mccarthy.pdf.

[10] Amanda Peterka, *Algae Companies Ask EPA to be able to Cash in on Power Plant Emissions*, GREENWIRE. Aug. 6, 2014.

[11] "The corresponding percentages of NGCC units that in 2012 operated at annual utilization rates of at least 65 percent and at least 75 percent were 16 percent and 6 percent, respectively." U.S. EPA, *Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, June 2, 2014, at Fn 127.

[12] *Utility Air Regulatory Group v. Environmental Protection Agency*, 573 U.S. ___ (2014).

These fundamental technical constraints raise serious questions as to how this country could meet growing electricity demand affordably and reliably while complying with EPA's proposed carbon regulations. As such, we are requesting that your Agency analyze the proposed guidelines taking these realities into account. Local, state, and regional level impacts must also be carefully considered. The effects of EPA's policies will vary dramatically and hinge on a wide variety of issues including everything from existing power resources and access to low cost alternatives to infrastructure constraints and energy demands. Americans deserve the bottom line: what does it cost and what will we get for the money?

Finally, EPA's failure to model impacts between 2030 and 2040 is a serious analytical shortcoming. The Administration has committed to reduce emissions by 83% by 2050. As a result, reductions beyond 2030 must be analyzed to understand the implications of this approach. Given the White House's promises in this regard, the target reduction for the power sector for 2040 should be modeled on a trajectory consistent with the implied 2050 target.

An expedited process would be greatly appreciated. Credible analysis is critical to a well-informed debate concerning climate change and energy policy choices now before American people. Please provide this analysis as specified below by September 15, 2014.

My staff is available to work with you to clarify any issues. Thank you for your prompt attention to this critical matter.

Sincerely,

Lamar Smith
Chairman
Committee on Science, Space, and Technology

cc: The Honorable Adam Sieminski, Administrator, Energy Information Administration, Department of Energy
John Podesta, Counsel to the President, Executive Office of the President
The Honorable John Holdren, Director, Office of Science and Technology Policy, Executive Office of the President
Rep. Eddie Bernice Johnson, Ranking Member, Committee on Science, Space, and Technology

Specifications for Analysis

Baseline Case:

The analysis should be based on EIA's Annual Energy Outlook 2014 (AEO2014) through 2040: baseline case "No GHG Concerns."

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Sensitivity Analyses:

Run on both the Policy Case and Alternative Policy Case described above.

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All price point information should be reported in both real and nominal dollars.

1. Disposable income.

2. Jobs impact.

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LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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August 13, 2014

The Honorable Adam Sieminski
Administrator
Energy Information Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

Dear Administrator Sieminski,

As the Administration considers regulations to reduce carbon emissions from fossil-fired power plants, the need for robust, objective, and well-grounded technical analysis of impacts on the American economy is imperative. The Environmental Protection Agency (EPA) has performed some analysis of its proposed Emissions Guidelines for Greenhouse Gas Emissions from Existing Stationary Sources: Electric Utility generating Units. Setting aside key legal and technical problems with EPA's novel approach to setting standards, EPA's compliance modeling disregards a number of confounding factors and broader economy-wide impacts.

We applaud the Energy Information Administration (EIA) for providing credible, transparent historical analyses over the years. As a result, we request that EIA analyze the impacts of the proposed guidelines using the specifications provided below. Given the magnitude of EPA's proposal, an expedited process would be greatly appreciated.

Because multiple analyses are important for understanding the possible impacts of the proposal, we are simultaneously asking EPA to re-run its model using the same specifications. This will allow for a side-by-side comparison of results. As requested of EPA, please provide your analysis by September 15, 2014. My staff is available to work with you to clarify any questions. Thank you for your prompt attention to this critical matter.

Sincerely,

Lamar Smith

Lamar Smith
Chairman
Committee on Science, Space, and Technology

cc: Gina McCarthy, Administrator, Environmental Protection Agency
Eddie Bernice Johnson, Ranking Member, Committee on Science, Space, and Technology

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    c. Provide the predicted sea level rise and temperature for each year.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 16 2014

OFFICE OF
AIR AND RADIATION

The Honorable Lamar S. Smith
Chairman
Committee on Science, Space, and Technology
U.S. House of Representatives
Washington, D.C. 20515-6301

Dear Chairman Smith:

Thank you for your letter of August 13, 2014, to U.S. Environmental Protection Agency Administrator Gina McCarthy regarding the Clean Power Plan for Existing Power Plants that was signed by the Administrator on June 2, 2014, and published in the *Federal Register* on June 18, 2014. In your letter, you made several comments regarding the EPA's proposed rule and the supporting technical analysis. The Administrator asked that I respond on her behalf.

The modeling platform that the EPA uses, the Integrated Planning Model (IPM), is reproducible, transparent, and peer reviewed. The EPA has used it for over two decades, and states, industry, and non-profit groups use it as well. We look forward to meeting with your staff to discuss this modeling in detail, including the state goal calculations and our illustrative compliance modeling.

Additionally, while the EPA is committed to continual improvement in the clarity of its analyses, the agency does not believe that the handful of issues identified by the Government Accountability Office (GAO) report referenced in your letter indicate any systematic deficiencies with respect to the accuracy of our analytical work. As mentioned in the EPA's comments on that report, economists have observed, "[Regulatory Impact Analyses] conducted by the EPA consistently rank at or near the top of the 17 agencies considered for all three categories of openness, analysis, and use."[1] Overall, the GAO report found that the EPA generally adhered to OMB guidance for regulatory analysis.

Detailed technical comments like yours are exactly the sort of feedback we are seeking from all interested parties, to ensure that we have all available information and the best available science as we analyze the effects of a final rule. The EPA has already received feedback and comments from a number of stakeholders on various aspects of the proposal, including the power sector modeling and the regulatory impact analysis. We will evaluate the comments contained in your letter, along with the other stakeholder input we receive during the comment period.

[1] R. Morgenstern, see http://www.rff.org/RFF/Documents/RFF-DP-11-17.pdf

Again, we encourage you and all interested parties to continue to provide us with detailed comments on all aspects of the proposed rule. The public comment period will remain open for 120 days, until October 16, 2014. We have submitted your letter to the rulemaking docket, but additional comments can be submitted via any one of these methods:

- Federal eRulemaking portal: http://www.regulations.gov. Follow the online instructions for submitting comments.
- E-mail: A-and-R-Docket@epa.gov. Include docket ID number HQ-OAR-2013-0602 in the subject line of the message.
- Fax: Fax your comments to: 202-566-9744. Include docket ID number HQ-OAR-2013-0602 on the cover page.
- Mail: Environmental Protection Agency, EPA Docket Center (EPA/DC), Mailcode 28221T, Attention Docket ID No. OAR–2013-0602, 1200 Pennsylvania Avenue, NW, Washington, DC 20460.
- Hand Delivery or Courier: Deliver your comments to: EPA Docket Center, Room 3334, 1301 Constitution Ave., NW, Washington, DC, 20460. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Again, thank you for your letter. If you have any further questions, please contact me or your staff may contact Kevin Bailey in the EPA's Office of Congressional and Intergovernmental Relations at bailey.kevinj@epa.gov or (202) 564-2998.

Sincerely,

Janet G. McCabe
Acting Assistant Administrator

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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October 20, 2014

The Honorable Gina McCarthy
Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20004

Dear Administrator McCarthy,

Thank you for your response to my August 13th, letter requesting comprehensive energy and economic modeling of the Environmental Protection Agency's (EPA) proposed Clean Power Plan for Existing Power Plants.

Unfortunately, your letter demonstrates a misunderstanding of my concerns on several key points. I want to be crystal clear: the American people deserve the facts. This is impossible without a comprehensive, real-world analysis of your proposed regulations.

My letter was in no way intended to merely provide technical input as part of the public comment process. Rather, it highlighted a few of the many serious problems with EPA's analysis that must be corrected before the rulemaking takes another step forward.

The flaws and deficiencies in EPA's modeling go far beyond those specifically identified by the Government Accountability Office. Systematic biases and major omissions in EPA's limited evaluation produced a cost-benefit analysis divorced from reality. Consequently, EPA's Regulatory Impact Assessment fails to assess whether the proposed rule will achieve meaningful benefits and, more importantly, whether the benefits are worth the heavy cost.

EPA's sweeping mandate requires a fundamental restructuring of our nation's energy system; it transforms how electricity is both produced and used. The broad new authority EPA claims raises critical questions about our ability to meet demand for reliable, affordable electricity.

With the close of the comment period rapidly approaching, the EPA must perform the requested analysis immediately. We cannot afford to ignore inconvenient details when the truth hangs in the balance. I appreciate your respect for our shared obligation to the American people to be transparent and honest.

The specifications for analysis are on pages five and six of the August letter, which is attached for your convenience. I look forward to your immediate attention to this pressing issue.

Sincerely,

Lamar Smith
Chairman
Committee on Science, Space, and Technology

Enclosure: Letter from Committee on Science, Space, and Technology to EPA Administrator McCarthy, August 13, 2014

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
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August 13, 2014

The Honorable Gina McCarthy
Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20004

Dear Administrator McCarthy,

For too long the Environmental Protection Agency (EPA) has hidden the truth from the American people. In order to regain public trust, the agency should rely on robust, objective, and well-grounded technical analysis of climate regulations. The EPA has performed limited analysis of its proposed Emissions Guidelines for Greenhouse Gas Emissions from Existing Stationary Sources: Electric Utility Generating Units. However, EPA's modeling suffers from a number of deficiencies that mask the rule's implications and limit its usefulness as a policy tool.

Setting aside key legal problems with EPA's novel approach to setting standards under section 111 of the Clean Air Act,[1] rigorous analysis through an open and transparent framework cannot be sacrificed in the name of expediency. Reassurances of "flexibility" are inadequate when considering regulations of this magnitude. Americans deserve an opportunity to see the facts.

Flaws in recent EPA analyses amplify concerns about the real impacts of these regulations. Last week the Government Accountability Office released a report highlighting a pattern of shoddy EPA analysis. It was revealed that EPA relied on decades old data and ignored important factors. The independent watchdog warned that "EPA cannot ensure that it's [analysis] provide the public with a clear understanding of its decision making."[2]

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[1] This letter and the modeling discussed herein do not address underlying problems with the legality and troubling one-size-fits-all approach to standard setting espoused in EPA's carbon guidelines. This modeling request focuses on compliance impacts. Nonetheless, I directed my staff to meet with your staff and review EPA modeling in detail: both standard setting modeling and compliance modeling. While your staff has been responsive in many regards, it is my understanding that you continue to delay this request. I respectfully ask you make the relevant staff available to facilitate these related discussions immediately.

[2] GAO, *EPA Should Improve Adherence to Guidance for Selected Elements of Regulatory Impact Analysis*, at 32 July 2014. *Available at* http://oversight.house.gov/wp-content/uploads/2014/08/GAOreport.pdf.

For example, EPA claimed that the Mercury and Air Toxics Standards (MATS) would retire just 4.7 gigawatts of power. Yet, the Energy Information Administration (EIA) now projects that 54 gigawatts of generating capacity, ten times more than EPA's projections, will close by the MATS compliance deadline.[3] EPA also said that MATS would increase electricity rates by just 1.3% to 6.3%. However, reports indicate that rate-payers are facing a 21% increase in rates this summer due to MATS power plant closures.[4] Further, EPA assured Americans that MATS would not result in reliability concerns, but Midwest grid operators now warn of an impending electricity shortage.[5]

EPA's failure to adequately model MATS impacts is all the more troubling in light of the fact that EPA itself now models up to 49 gigawatts of plant closures due to the proposed section 111 regulations. If past performance is an indication, could this number double, triple, or worse? Without public access to all underlying assumptions, modeling mechanisms, and results, it is impossible to know whether the Agency has corrected the core deficiencies that resulted in the gross underestimation of impacts. Americans cannot afford to pay for EPA's mistakes.

The Agency should provide an analysis that takes real-world contingencies into account. Although Congress is currently acting on legislation that would prohibit EPA's use of non-transparent methodologies in the development of its rules,[6] EPA continues to rely on models that are not publicly available.[7] Consequently, we are simultaneously asking the EIA to independently model the same specifications. Tandem analysis by EPA and EIA will allow for a side-by-side comparison results and provide a more comprehensive accounting of the possible impacts of the agency's proposal.

EPA's incomplete modeling disregards a number of technical, regulatory, and economic realities.[8] These omissions have the effect of downplaying the possible energy and economic impacts of this proposal while simultaneously ignoring the lack of climate benefits. The costs of any greenhouse gas policies are directly proportional to the price and availability of viable technologies. In the case of base load power, these options include carbon capture and storage (CCS), natural gas, nuclear, and hydro-electric in some locations. In its analysis, the EPA assumes that these technologies are available and relatively affordable throughout the lifetime of the policy and beyond. But the facts paint a different picture.

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[3] Energy Information Administration, *AEO2014 Projects More Coal-Fired Power Plan Retirements Than Have Been Scheduled*, Feb. 14, 2014.

[4] Julie Wernau, *Higher Electric Bill to Jolt Chicago Area*, CHI. TRIB. May 8, 2014.

[5] Midcontinent Independent Systems Operator, *OMS/MISO Resource Adequacy Survey Update* 3, Jan. 31, 2014.

[6] H.R. 4012, The Secret Science Reform Act of 2014, requires that the EPA base its regulations and assessments on science that is publicly available in a manner sufficient for independent analysis and scientific replication. Legislation and Status *available at:* http://thomas.loc.gov/cgi-bin/bdquery/z?d113:h.r.04012:. Senator Barrasso introduced a Senate companion bill, S. 2613, on July 16, 2014.

[7] EPA relies on a proprietary model, the Integrated Planning Model (IPM), whose results cannot be verified independently. The reliance on proprietary models by EPA potentially violates the Data Quality Act.

[8] This proposal will have ripple effects throughout the wider economy as higher electricity and natural gas prices create drag on other sectors. No rule should proceed absent peer-reviewed economy-wide modeling. However, EPA has not attempted to model these impacts but is establishing a "Science Advisory Board panel on economy-wide modeling to consider the technical merits and challenges of using this analytical tool to evaluate costs, benefits, and economic impacts in regulatory development." RIA at 5-2.

For example, notwithstanding the Administration's claim that CCS is "adequately demonstrated," serious questions remain about its technological and economic viability beyond unique applications. At the same time, the EPA is poised to choke off the only economically viable CCS option, enhanced oil recovery, by putting in place regulations that would preclude its use as a carbon abatement option.[9] Furthermore, EPA has refused to recognize the use of other carbon utilization technologies for compliance purposes.[10] There is no evidence that EPA's modeling has taken these considerations into account.

In addition to issues related to the use of coal, concern about climate change has reinforced opposition in some quarters against other types of energy production. In the case of natural gas, continued access at today's historically low prices is questionable in the face of special-interest opposition to drilling and the specter of additional federal regulations. Further, EPA's sweeping assumption that natural gas plants can increase annual utilization to 70% across the entire fleet, presents huge technological challenges both at the plants and within the supply chain. EPA's proposal admits that 70% utilization rates have been exceptionally rare;[11] consequently, assertions of technical feasibility require detailed modeling, contingency planning, and real-world testing. There is no evidence that EPA's modeling has taken many of these and other confounding factors into account.

Over the past decade, there has been a renewed interest in nuclear power as an alternative to fossil fuels. Yet despite greater acceptance of this emissions-free energy resource, nuclear power faces a host of obstacles and uncertainties that could not only inhibit its expansion, but will accelerate retirements from the existing fleet. EPA's modeling fails to adequately consider the challenges facing our existing nuclear fleet.

The Agency also fails to model the significant uncertainty presented by challenges to the rule. For example, a recent Supreme Court decision underscored the possibility of successful legal challenges, particularly with respect to EPA's "beyond the fence" analysis.[12] EPA claims the various "building blocks" that form the basis of its proposal are severable – meaning the rule could stand, but one or more of the various emissions reductions strategies upon which it is based could be eliminated. There is also considerable uncertainty as to whether states will embrace EPA's proposal and implement it through a State Implementation Plan (SIP) like process. Consequently, if the Agency forcibly imposes a federal implementation plan on states, EPA's options may be limited to regulating the power plants themselves. Accordingly, an alternative policy analysis should assess the impact of the guidelines under a scenario limited to heat rate improvements and dispatch changes among affected power plants.

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[9] *See generally* Letter from U.S. House of Representatives Committee on Science, Space, and Technology to EPA Administrator Gina McCarthy, Dec. 19, 2013. *Available at* http://science.house.gov/sites/republicans.science.house.gov/files/documents/Letters/121913_mccarthy.pdf.

[10] Amanda Peterka, *Algae Companies Ask EPA to be able to Cash in on Power Plant Emissions*, GREENWIRE. Aug. 6, 2014.

[11] "The corresponding percentages of NGCC units that in 2012 operated at annual utilization rates of at least 65 percent and at least 75 percent were 16 percent and 6 percent, respectively." U.S. EPA, *Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, June 2, 2014, at Fn 127.

[12] *Utility Air Regulatory Group v. Environmental Protection Agency*, 573 U.S. ___ (2014).

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