Written Testimony

Hearing of the Subcommittee on Energy and Air Quality

Committee on Energy and Commerce
United States House of Representatives

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Thank you, Chairman Boucher, Ranking Member Upton, and Members of the Subcommittee. I am Steve Specker, President and CEO of the Electric Power Research Institute (EPRI). EPRI appreciates the opportunity to provide testimony on HR 6258, the Carbon Capture and Storage Early Deployment Act.

EPRI is an independent, non-profit research organization that brings together its members, scientists and engineers, along with experts from academia, industry and other centers of research to:

- collaborate in solving challenges in electricity generation, delivery and use;
- provide technological, policy and economic analyses to drive long-range research and development planning
- support multi-discipline research in emerging technologies and issues; and
- accelerate the commercial deployment of advanced electricity technologies

The Promise of Carbon Capture and Storage

Recent EPRI work[1] has illustrated the necessity and the urgency to develop carbon capture and storage (CCS) technologies as part of the solution to satisfying our future energy needs in an environmentally responsible manner. Our analysis suggests that with aggressive research, development, demonstration, and deployment of advanced electricity technologies, it is technically feasible to slow down and stop the increase in U.S. electric sector CO_2 emissions, and then eventually reduce them over the next 25 years while simultaneously meeting the expected increased demand for electricity and minimizing the economic impact of reducing emissions.

[1] "The Power to Reduce CO_2 Emissions: the Full Portfolio", EPRI 1015461, August 2007, www.epri.com

To develop this analysis, we compiled data on the current and likely future cost and performance of various electricity technologies from our own internal work, various public-private technology research, development, and demonstration (RD&D) roadmaps, and expert opinions from academia, industry, and the NGO community in the published literature. From this information, EPRI assessed the benefits of achieving substantial improvements in performance and aggressive deployment of advanced technologies in seven areas: end-use efficiency, renewables, nuclear generation, advanced coal generation, CCS, plug-in hybrid electric vehicles (PHEV) and distributed energy resources (DER). We then calculated the net change in CO_2 emissions from the electric sector which would result from achieving each of those technology targets compared to the underlying assumptions in the Base Case of the 2008 Annual Energy Outlook[2] published by the Energy Information Administration (EIA). The results are shown in Figure 1.

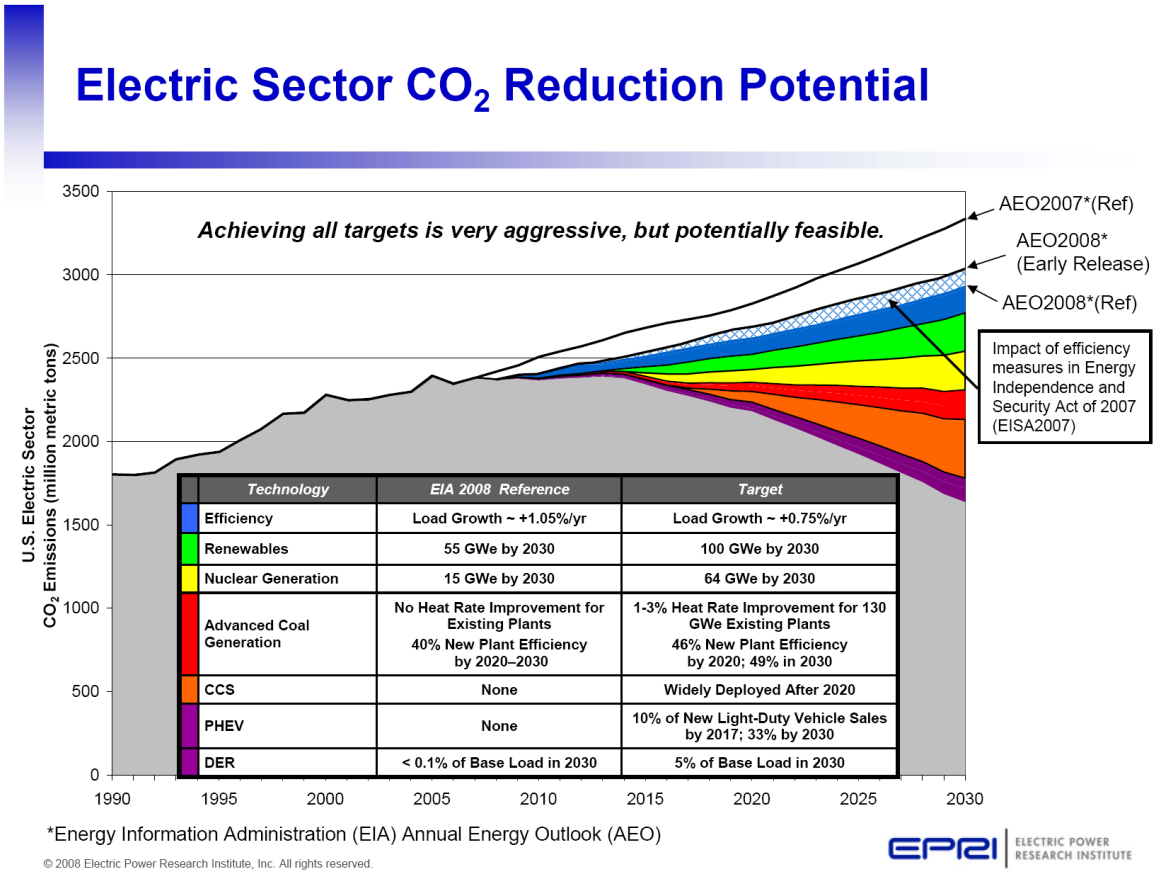

Figure 1: Technical potential for CO_2 emissions reductions from the U.S. electric power sector, assuming significant new technology RD&D investments and the aggressive deployment of the resulting technologies over the next 25 years.

[2] "Annual Energy Outlook 2008", Energy Information Administration, U.S. Department of Energy, June 2008, DOE/EIA-0383 (2008), www.eia.doe.gov

Of the seven options we analyzed, our work showed that the greatest reductions in future U.S. electric sector CO_2 emissions are likely to come from applying CCS technologies to nearly all new coal-based power plants coming on-line after 2020. The key to proving CCS capability is the demonstration of CCS at large-scale (on the order of 1 million tons CO_2/year) for integrated gasification combined-cycle (IGCC), for pulverized coal (PC) and for oxy-combustion technologies, with storage in a variety of geologies. This will require a sustained RD&D program at heightened levels of investment and the resolution of legal and regulatory unknowns for long-term geologic CO_2 storage. We must start immediately if we are to meet the goal of demonstrating a full portfolio of advanced coal technologies with CCS by 2020.

Furthermore, we have conducted a companion economic analysis showing that investments in RD&D which lead to the creation of a full portfolio of low-carbon electricity technologies, including advanced coal-based power plants with CCS and new expansions in nuclear power, can significantly reduce the costs of future climate policy. For a scenario in which we aspire to reduce U.S. emissions of CO_2 in 2050 to less than half of today's levels, this "full portfolio" would result in average wholesale electricity prices equivalent to approximately 9¢ per kilowatt-hour, compared to 21¢ per kilowatt-hour – more than twice as much – in the case where a "limited portfolio" of electricity technologies (i.e. excluding CCS or expansion of nuclear power) is available. Carbon prices are also twice as large in the world of the "limited portfolio". In a world without CCS and nuclear, future CO_2 constraints would be met by massive fuel switching to natural gas (with resulting price increases and increasing import dependence) and by increasingly expensive energy conservation as consumers respond to very large carbon and electricity prices.

For this hypothetical CO_2 constraint, the existence of the "full portfolio" reduces the overall cost of the climate policy to the U.S. economy by approximately $1 trillion between now and 2050. Furthermore, the low-cost, low-carbon electricity provided by the "full portfolio" would play an essential role in enabling CO_2 reductions from other sectors of the economy. This is more than enough to justify the additional investments in the RD&D we must make now to develop the necessary portfolio of low-cost, low-carbon technologies, particularly CCS.

EPRI's Collaborative Governance and Operating Model

EPRI is designated in HR 6258 as the institutional foundation for the Carbon Storage Research Corporation, which would award grants and contracts to large-scale projects that will advance the commercial availability of CCS technology. Our 35 years of experience as a collaborative public interest RD&D organization makes EPRI well suited to successfully fulfill this role.

Our current governance and operating model serves as a good comparison to the type of governance and management structure proposed in HR 6258 and demonstrates our ability to effectively work within a collaborative framework representing multiple stakeholder

groups. From this sound basis, EPRI can promptly establish the needed structures and processes to launch the Carbon Storage Research Corporation.

EPRI's research initiatives are shaped by advice from public as well as different private and government viewpoints. Our Board of Directors has 33 members, including representation from federal power (TVA and Bonneville Power), municipal, cooperative, and investor-owned utilities, ISO/RTOs, and includes six external directors drawing upon different experienced groups such as academia. Our Board oversees the management of the Institute, including our strategic research objectives, financial plan, and compliance practices.

EPRI management and EPRI's Board also draw upon the experiences and viewpoints of our Advisory Council consisting of 30 leaders from environmental, academic, labor, business and supplier organizations; and including 10 state public utility commissioners. Our Advisory Council helps us consider the impact of societal and public policy needs when we evaluate the direction of our various research programs.

EPRI is uniquely suited to bring together diverse industry, business and public viewpoints regarding the proposed work. EPRI is not a trade association; rather, EPRI is recognized by the IRS as a 501(c)(3) tax exempt scientific research organization, operating in the public interest and for the public benefit. Our charter, which is attached to this testimony, provides additional information on the purposes for which EPRI was organized.

EPRI has a strong public interest mission that helps shape the scope and direction of our work, extending through all areas of electricity generation, delivery, and use. It requires that we conduct our RD&D activities with the utmost objectivity and scientific integrity. Our collaborative model extends throughout our RD&D operations as EPRI's scientists and engineers work with EPRI utility members and experts from academia, government and other business sectors. Our objective is to assemble the best technical teams available to conduct our work.

EPRI's work is financially supported on a voluntary funding basis by its U.S. members, who represent more than 90% of the electricity generated and delivered in the United States; and by international participants from about 40 countries. EPRI has major offices and laboratories in Palo Alto, California; Charlotte, North Carolina; Knoxville, Tennessee; and Lenox, Mass.

EPRI's Demonstration Project Experience

EPRI's leadership in the RD&D of advanced electricity technologies is well recognized throughout the utility industry and the broader global energy community.

Working closely with a wide range of industry participants, governmental agencies, equipment manufacturers, and utilities, EPRI has helped lead demonstration programs

that were instrumental in accelerating the deployment of several technologies including the following examples:

- The first commercial scale IGCC plant in the United States was demonstrated by an EPRI–led collaborative in the late 1980s. The Cool Water Program, which established the early technical foundation for future IGCC plants, included companies such as Texaco, GE, Bechtel, and Southern California Edison.

- The Environmental Control Technology Center which EPRI constructed and operated from 1989 to 1999 to demonstrate technologies for controlling emissions of sulfur dioxide, nitrogen oxides and particulate matter. The collaborative program involved U.S. and international electric utilities, energy suppliers and Federal and State research organizations.

- The Advanced Light Water Reactor Program, a $1 billion public-private partnership that operated for over a decade, was coordinated by EPRI in cooperation with the U.S. Department of Energy, electric utilities, and reactor suppliers. The program resulted in the technical basis for today's advanced nuclear plants, currently in operation and being constructed internationally and for which construction and operating license applications have been announced in the United States.

EPRI is also a key leader in the recently-launched carbon capture pilot project at We Energies' Pleasant Prairie Power Plant in Wisconsin. This project represents a milestone in efforts to capture CO_2 from the flue gas of a pulverized-coal generating station. The 1.7-MWe system, designed and constructed by Alstom, uses their chilled ammonia process which, based on laboratory experiments, has the potential to capture more than 90% of CO_2 in the flue gas, at a cost lower than other technologies currently available. As part of the collaboration, EPRI will conduct a year-long series of performance tests and cost analyses. EPRI's collaborative process brought together more than 35 organizations to support this project, including a large number of U.S. coal-based utilities and international participants.

As part of our efforts to help enable CCS technology for widespread deployment after 2020, EPRI will create and lead industry collaboratives for several additional and important CCS demonstrations. Working in cooperation with US and international utilities and equipment suppliers, EPRI will carry out plant design, performance and economic analysis and use the data it collects to prepare independent, third-party technical and economic evaluations of the technologies involved. These projects are:

- A planned 20 MW post-combustion CCS demonstration by American Electric Power at their Mountaineer Plant in West Virginia.
- A planned ~25 MW post-combustion CCS demonstration by Southern Company at a power plant in their service territory.
- Three projects of increasing CO_2 capture scale intended to demonstrate cost-competitive IGCC plants with high efficiency, near-zero emissions, and CCS.

- Additional support for a DOE-funded pre-commercial demonstration of an advanced oxygen separation system for use in future IGCC and oxy-combustion plants

EPRI has also initiated a companion set of demonstration projects associated with energy efficiency, the "smart grid", and energy storage; and a potential second round of demonstration projects focused on renewable energy is under development.

We are also working to develop additional CCS project proposals for:

- Further scale up of the post-combustion capture technologies outlined above, potentially as retrofits for existing units;
- Initial demonstration of oxy-combustion technologies at a power plant at pre-commercial scale; and
- One or more "UltraGen" full-scale pulverized coal plants with ultra-supercritical steam conditions, near-zero emissions, and CCS.

These projects, and others that would be needed to advance CCS technology, would benefit from the funding established in HR 6258, or other Federal support in the forms of tax incentives, loan guarantees or DOE cost-shared grant funding were HR 6258 not to be enacted into law.

Program Scale Proposed in HR 6258

Developing the suite of technologies needed to achieve competitive advanced coal and CCS technologies will require a sustained major additional investment in RD&D, over and above the support currently provided through Department of Energy programs.

The proposed funding of $1.0 billion per year for 10 years envisioned in HR 6258 is consistent with RD&D funding needs estimated by a number of independent organizations, including EPRI, the Coal Utilization Research Council[3], the National Coal Council[4] and MIT[5]. As part of our assessment of RD&D funding needs necessary to support development of the "full portfolio" of advanced electricity technologies, EPRI estimated additional RD&D funding needs for advanced coal with CCS to range from $700 million - $1.0 billion/year for each of the next 25 years. The MIT *Future of Coal* report estimated the funding need at $800–$850 million per year, which approaches the EPRI value. Were we to conduct these same studies today, recent increases in costs for materials, labor and other inputs associated with the new construction of power plants of all types would likely lead to increased estimates on the order of the $1.0 billion per year funding level contained in HR 6258.

[3] The CURC-EPRI Clean Coal Technology Roadmap, Coal Utilization Research Council, 2007, http://www.coal.org/userfiles/File/Final_CURC-EPRI_Roadmap,_2008.pdf
[4] "Coal: America's Energy Future – The National Coal Council Report", National Coal Council, 2006, http://www.coalamericasenergyfuture.com/index2.html
[5] "The Future of Coal: Options for a Carbon-Constrained World", Massachusetts Institute of Technology, 2007, http://web.mit.edu/coal/The_Future_of_Coal_Summary_Report.pdf

We stress that no single advanced coal generation technology has clear-cut economic advantages across the range of U.S. and global applications. HR 6258 properly recognizes this. While there are well proven methods for capturing CO_2 resulting from coal gasification, IGCC plants will have larger components and a degree of integration that has not been demonstrated at the commercial scale. In contrast, pulverized coal technology is well proven commercially in the power industry, but demonstration of post combustion capture is yet to be proven at a commercial and affordable scale. These and other promising approaches merit consideration for RD&D funding under HR 6258, as do technologies that are suitable for either new plants or retrofit applications on existing plants (which are overwhelmingly pulverized coal).

Furthermore, there is still much work to be done before CCS can be implemented on a scale large enough to significantly reduce CO_2 emissions into the atmosphere. In addition to large-scale demonstrations at U.S. geologic formations, many legal, institutional and regulatory uncertainties need to be resolved. Uncertainty about long term monitoring requirements, liability, and insurance is an example. State-by-state variation in regulatory approaches is another. Some geologic formations suitable for CO_2 storage underlie multiple states. For private companies considering CCS, these various uncertainties translate into increased project risk that may hinder the progress of commercial-scale CCS demonstrations.

Conclusion

EPRI supports the concept of a focused RD&D fund for the development of large-scale projects to advance the commercial availability of CCS technologies. We have the collaborative governance and operating model and the technical experience to successfully implement the program on an accelerated timetable that matches the urgency of our need. Thank you for the opportunity to address the Subcommittee.

Attachment #1
Articles of Incorporation
Of the Electric Power Research Institute, Inc.

As amended through April 4, 2006

3. The purposes for which the Corporation [EPRI] is organized are

   (a) To promote, engage in, conduct and sponsor research and development with respect to electricity production, transmission, distribution and utilization, and all activities directly or indirectly related thereto;

   (b) To provide a medium through which investor-owned, government-owned and cooperative-owned power producers and all other persons interested in the production, transmission, distribution or utilization of electricity can sponsor electricity research and development for the public benefit;

   (c) To promote, engage in and conduct research in both the pure and applied sciences for the advancement and betterment in the public service of the production, transmission and distribution of electric power;

   (d) To sponsor scientific research and development in the electric power field with a view towards providing economical, reliable electric service to the public with minimal adverse environmental effects;

   (e) To discover, devise, develop, invent and create, through study and research, the methods and means to improve the production, transmission, distribution and utilization of electric power, in order to insure the adequate power supply that is vital to the progress of the nation and the world community;

   (f) To seek and ascertain, through scientific research and development, solutions to environmental problems related to the production, transmission, distribution and utilization of electric power;

   (g) To undertake, conduct, engage in or direct research and development activities for the discovery or improvement of new or more efficient forms of electric power production, transmission and distribution and of improved utilization, including new or more efficient uses, of electric power by the public;

   (h) To discover and develop, through scientific study, research ways and means to protect, conserve, and maximize the efficient utilization of finite natural resources used in the production, transmission and distribution of electric power;

(i) To provide a medium for coordination and cooperation and for the exchange of information for all organizations and persons, public or private, concerned with electric power scientific research and development;

(j) To ascertain, prepare and disseminate information and data with respect to scientific research and development activities in the field of electric power;

(k) To educate and instruct the public on electric power subjects useful to the individual and beneficial to the national as well as worldwide communities;

(l) To have all those powers conferred upon corporations organized under the Non-profit Corporation Act necessary to effect any or all the purposes for which the corporation is formed subject to any limitations contained in these Articles of Incorporation or the laws of the District of Columbia.