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

HEARING CHARTER

The Department of Energy Fiscal Year 2012 Research and Development Budget

Thursday, March 3, 2011
10:00-12:00
2318 Rayburn House Office Building

PURPOSE

On Thursday, March 3, 2011, the Committee on Science, Space, and Technology will hold a hearing entitled "***The Department of Energy Fiscal Year 2012 Research and Development Budget."*** The purpose of the hearing is to receive testimony from the Secretary of Energy on the President's Fiscal Year (FY) 2012 budget request for energy research and technology development programs at the Department, including activities under the Office of Science, Energy Efficiency and Renewable Energy, Advanced Research Projects Agency–Energy, Fossil Energy, Nuclear Energy, Electricity Delivery and Energy Reliability, and the Loan Guarantee Program Office.

WITNESS

Dr. Steven Chu, *U.S. Secretary of Energy*. Dr. Chu was confirmed as the 12th Secretary of Energy on January 20, 2009. Prior to his appointment Dr. Chu was the Director of DOE's Lawrence Berkeley National Laboratory, and a professor of Physics and Molecular and Cell Biology at the University of California. He was the co-winner of the 1997 Nobel Prize for Physics.

Department of Energy (DOE) Spending

(dollars in millions)

Program	FY08 Actual	FY10 Enacted	FY11 Request	FY11 CR*	FY12 Request	FY12 Request versus FY10 Enacted	
						$	%
Office of Science							
Advanced Scientific Computing Research	*351.0*	*383.2*	*426.0*	-	*465.6*	*82.4*	*21.5*
Basic Energy Sciences	*1270.0*	*1599.0*	*1835.0*	-	*1985.0*	*386.0*	*24.1*
Biological and Environmental Research	*544.0*	*588.0*	*627.0*	*302.0*	*717.9*	*129.9*	*22.1*
Fusion Energy Sciences	*287.0*	*417.7*	*380.0*	-	*399.7*	*(18.0)*	*(4.3)*
High Energy Physics	*689.0*	*790.8*	*829.0*	-	*797.2*	*6.4*	*0.8*
Nuclear Physics	*433.0*	*522.5*	*562.0*	-	*605.3*	*82.8*	*15.9*
Office of Science	**4083.0**	**4964.0**	**5121.0**	**4017.7**	**5416.0**	**452.0**	**9.11**
Energy Efficiency and Renewable Energy (EERE)							
Hydrogen Technology	*211.1*	*170.3*	*0.0*	-	*0.0*	*(170.3)*	*(100)*
Hydrogen and Fuel Cell Technologies	*0.0*	*0.0*	*137.0*	-	*100.5*	*100.5*	*n/a*
Biomass and Biorefinery Systems	*198.2*	*216.2*	*220.0*	-	*340.5*	*124.3*	*57.5*
Solar Energy	*168.5*	*243.4*	*302.4*	-	*457.0*	*213.6*	*87.8*
Wind Energy	*49.6*	*79.0*	*122.5*	-	*126.9*	*47.9*	*60.6*
Geothermal Technology	*19.8*	*43.1*	*55.0*	-	*101.6*	*58.5*	*135.7*
Water Power	*9.9*	*48.7*	*40.5*	-	*38.5*	*(10.2)*	*(20.9)*
Vehicle Technologies	*213.0*	*304.2*	*325.3*	-	*588.0*	*283.8*	*93.3*
Building Technologies	*109.0*	*219.0*	*230.7*	-	*470.7*	*251.7*	*114.9*
Industrial Technologies	*64.4*	*94.3*	*100.0*	-	*319.8*	*225.5*	*239.1*
Energy Efficiency and Renewable Energy (EERE)	**1704.0**	**2242.5**	**2355.0**	**1467.4**	**3200.0**	**957.5**	**42.70**
Nuclear Energy R&D	**438.0**	**487.0**	**396.0**	**661.1****	**447.4**	**(39.6)**	**(8.1)**
Electricity Delivery and Energy Reliability R&D	**82.8**	**168.5**	**144.3**	**139.0**	**192.8**	**24.3**	**14.4**
Fossil Energy R&D	**888.5**	**659.3**	**760.0**	**586.6**	**453.0**	**(206.3)**	**(31.3)**
ARPA-E	**n/a**	**0.0**	**300.0**	**50.0**	**650.0*****	**650.0**	**n/a**
Loan Guarantee Program Office	**4.6**	**0.0**	**0.0**	-	**305.0**	**305.0**	**n/a**
Totals:	**7200.9**	**8521.3**	**8776.3**	**6921.8**	**10014.2**	**1492.9**	**14.9**

*as passed by the House on February 12

**Includes the entire Office of Nuclear Energy

***$100 million of the $650 million ARPA-E request is proposed to be paid for through revenues collected from auction of wireless broadcast spectrum.

BACKGROUND

The Department of Energy (DOE) funds a wide range of research, development, demonstration, and commercial application activities. DOE's primary mission is to "advance the national economic, and energy security of the United States; to promote scientific and technological innovation in support of that mission; and to ensure the environmental cleanup of the national nuclear weapons complex."[1] In order to fulfill its mission, DOE operations are guided by five strategic themes: energy security, nuclear security, scientific discovery and innovation, environmental responsibility, and management excellence.

The overall FY 2012 budget request for DOE is $29.5 billion, which represents a $3.1 billion or 11.8 percent increase over FY 2010 levels. Approximately one third of this amount is dedicated to programs within the Committee on Science, Space, and Technology's jurisdiction. The balance of DOE's funding is allocated to the National Nuclear Security Administration (NNSA), to maintain our stockpile of nuclear weapons, and Defense and Non-Defense Environmental Management (EM) programs, to manage the cleanup of nuclear weapons production and government-sponsored nuclear energy research.

DOE R&D PROGRAMS AND OFFICES

Office of Science

The total FY 2012 budget request for the Office of Science (SC) is $5.4 billion, a $452 million or 9.1 percent increase over the FY 2010 levels. The mission of the Office of Science is the delivery of scientific discoveries, capabilities, and major scientific tools to transform the understanding of nature and to advance the energy, economic, and national security of the United States. In support of this mission, SC supports basic research in the following areas: advanced scientific computing, basic energy sciences, biological and environmental research, fusion energy sciences, high energy physics, and nuclear physics. SC's operations take place in three main areas: selection and management of research; operation of world-class, state-of-the-art scientific facilities; and design and construction of new facilities. SC also supports several ongoing interagency initiatives such as the Networking and Information Technology Research and Development program; the National Networking Initiative; the United States Global Change Research Program; and the Climate Change Technology Program. SC provides 45 percent of Federal support of basic research in the physical sciences and key components of the Nation's basic research in biology and high-end computing.

Office of Science budget and activities are divided into the following six major program areas:

Basic Energy Sciences (BES) requests $1.99 billion, an increase of $386 million (or 24.1 percent) over FY 2010 levels. BES supports basic research into the fundamental building blocks necessary for advancing new energy technologies, and maintains world-class research facilities to develop new knowledge and facilitate advances in areas such as materials science and chemistry.. The FY 2012 budget reiterates the FY 2011 request for $34 million to fund a new

[1] All DOE mission statement quotes come from the cited office's website.

Batteries and Energy Storage Energy Innovation Hub. Additionally, the existing Fuels from Sunlight Hub requests $24.3 million.

In order to realize significant research gains and advance new research methodology, in 2009 BES initiated the creation of Energy Frontier Research Centers (EFRCs.) EFRCs are individually funded between $2-5 million per year to conduct focused research from a small team to solve "grand challenges" associated with disruptive scientific advances. DOE requests continued funding of all 46 existing EFRCs in FY 2012.

Biological and Environmental Research (BER) requests $717.9 million in the President's budget, which is $129.9 million (22.1 percent) over FY 2010 funding. BER examines fundamental biological systems, climate, and environmental sciences. Specifically, BER researches genomics, drivers of climate change, and deeper environmental issues. The request also includes support for the three DOE Bioenergy Research Centers, the Joint Genome Institute, and Environmental Molecular Sciences Laboratory.

BER is also a major contributor to the Intergovernmental Panel on Climate Change (IPCC) by providing expertise in climate modeling and simulations. The FY 2012 budget request includes notable funding increases for BER given pending work on the IPCC's Fifth Assessment.

The budget would provide $465.6 million for **Advanced Scientific Computing Research (ASCR)**, an increase of $82.4 million (21.5 percent) over FY 2010 levels. A sizable portion of the increase is slotted for National Leadership Computing Facilities, the nation's most powerful open resource for capability computing located at Oak Ridge National Laboratory and Argonne National Laboratory. Continued investigation of a potential exascale computing project to increase computational capacity by a thousand-fold accounts for the remainder of the requested additional funds.

The request for **Fusion Energy Sciences (FES)** is $399.7 million, a decrease of $18 million (4.3 percent) below FY 2010 funding. FES supports research to improve fundamental understanding of matter at very high temperatures and densities needed to develop fusion energy. The contribution to the international ITER project, a partnership to demonstrate the first fusion prototype, would be reduced by $30 million.

The FY 2012 funding request for **High Energy Physics (HEP)** is $797.8 million, a $6.4 million (0.8 percent) increase from the enacted FY 2010 level. HEP probes the basic relationship between space and time, the elementary constituents of matter and energy, and the interactions between them. This effort is concentrated on three scientific frontiers: the energy frontier, the intensity frontier, and the cosmic frontier.

Nuclear Physics (NP) would receive $605.3 million, an increase of $82.8 million (15.9 percent) over FY 2010 funding. This program supports research to discover and understand various forms of nuclear matter. It also supports the production and development of techniques to make isotopes that are in short supply for medical, national security, environmental, and other research applications.

Energy Efficiency and Renewable Energy

The mission of the Office of Energy Efficiency and Renewable Energy (EERE) is to "strengthen the United States' energy security, environmental quality, and economic vitality in public-private partnerships." EERE supports this mission statement by: "Enhancing energy efficiency and productivity; bringing clean, reliable and affordable energy technologies to the marketplace; and making a difference in the everyday lives of Americans by enhancing their energy choices and their quality of life." EERE participates in many crosscutting activities with other departments, as well as within DOE offices, including collaborations with the Office of Science, the Advanced Research Projects Agency - Energy, Office of Electricity, Fossil Energy, Federal Energy Management Program, and the Loan Guarantee Program Office.

The Administration's budget request of $3.2 billion for EERE represents a $958 million (44.4 percent) increase over FY 2010 levels. This reflects the President's call in his State of the Union speech for increased spending on clean energy technologies. The budget requests significant funding increases for most EERE programs relative to the FY10 enacted level. Additionally, EERE is increasing the number of staff in their Washington, DC headquarters, while decreasing field FTEs.

The proposed funding for the **Solar Energy** program is $457 million, an increase of $213.6 million (87.8 percent) over FY 2010 levels. This request intends to fund the "SunShot" initiative recently proposed by the Administration. As a part of this initiative, EERE is advancing a "Dollar-a-Watt" program to make solar energy to be cost-competitive with fossil fuels without subsidies. To achieve this goal, solar generation needs to reach a four to five cents/kWh equivalent installed price for solar photovoltaics (PV) energy by 2020, or reduce the installed cost of solar electricity by approximately 75 percent from current costs. Accordingly, an overwhelming percentage of solar energy's increased funding is directed to the PV subprogram. EERE will also continue to fund the Concentrating Solar Power (CSP) subprogram for further research in CSP development and thermal storage activities. As a means to accelerate widespread market adoption of solar energy, the program also seeks to improve applicable local codes, permitting, education and training.

The FY 2012 funding request for the **Wind Energy** program is $126.9 million, an increase of $47.8 million (60.6 percent) over FY 2010 levels. The request continues funding a demonstration project to develop offshore wind technology, and aims to address financial, regulatory, technical, environmental, and social issues associated with offshore wind.

The FY2012 **Biomass and Biorefinery Systems** budget request is $340.5 million, an increase of $124.3 million (57.5 percent) over the FY 2010 level. This program aims to develop and transform domestic, renewable, and abundant biomass resources into cost-competitive, high performance biofuels, biopower, and bioproducts through targeted planning, research, development and demonstration. In FY 2012, funding for feedstock production trials will be eliminated. The elimination is offset by a major increase of $150 million to expand the Cellulosic Biofuels Reverse Auction with the intention of rapidly injecting money into the emerging cellulosic biofuels industry. Support for integrated biorefinery projects also notably decreases with increased focus on R&D for downstream deployment efforts.

The proposed funding level for the **Geothermal Technology** program is $101.5 million, an increase of $58.4 million (135.5 percent) over FY2010. This program seeks to broaden its focus to include technologies with a near-term impact by confirming undiscovered hydrothermal resources with innovative exploration technologies. Additionally, the Enhanced Geothermal Systems subprogram is aiming to advance new technologies to use waste carbon dioxide to capture heat and make electricity.

The Administration's budget request provides a total of $38.5 million for the **Water Power** program, which is a $10.2 million (20.9 percent) decrease from FY 2010 enacted levels. The program funds incremental hydropower development and demonstrates marine and hydrokinetic (MHK) technologies. The funding will support full-scale MHK open water demonstration projects to establish the baseline cost of MHK generated electricity by 2013.

The **Hydrogen and Fuel Cell Technologies** (HFCT) program requests $100.5 million; a $70 million or 41 percent decrease from FY 2010 levels. The decrease reflects EERE refocusing of specific R&D on fuels cells for stationary, transportation and portable power applications.

The budget request for the **Buildings Technologies Program** (BTP) is $470.7 million, a $252 million (114.9 percent) increase over FY 2010 levels. BTP supports efforts to improve the energy efficiency of new and existing homes and buildings primarily through advanced building technologies, controls, systems, and whole-building design; demonstration of integrated approaches for construction; bringing transformational tools to the market place; supporting the ENERGY STAR program; supporting the adoption, training, and enforcement of building codes; and promulgating and finalizing efficiency standards as required by law. The Energy Efficient Buildings Systems Design Hub is administered by BTP.

BTP's FY 2012 request includes the President's new *Better Buildings Initiative*, which aims to achieve a 20 percent improvement in commercial building energy efficiency by 2020. In addition to increased R&D funding for building technologies, the initiative includes new tax incentives for commercial building energy efficiency projects and financing opportunities for state and municipal governments through the "Race to the Green" competitive grant program. The initiative would also receive funding from the Loan Guarantee Program Office.

The **Vehicle Technologies Program** (VTP) requests $588 million, an increase of $283 million (93 percent) over the FY 2010 level. The increase reflects an emphasis on the development and deployment of plug-in hybrid vehicles (PHEVs). Specifically, in support of the President's goal to place one million electric vehicles on the road by 2015, VTP is requesting $229 million proposing to fund infrastructure development for transportation electrification, including a major new program of grants to communities for upgrading electric vehicle infrastructure.

The **Industrial Technologies Program** (ITP) request is $319.8 million, an increase of $225.5 million (239.2 percent) over FY2010 levels. ITP seeks to revolutionize industry's energy and carbon intensity by developing manufacturing technologies, materials, and clean energy manufacturing capacity. The Next Generation Materials and Next Generation Manufacturing Processes subprograms are both drastically increased to assist in attaining this goal. Additionally, the request proposes the creation of an Energy Innovation Hub on critical

materials. A new $50 million Energy Efficiency Partnership is included to assist industry incorporation of energy efficient technologies into existing facilities.

The Advanced Research Projects Agency –Energy (ARPA-E)

The Administration requests $650 million for the Advanced Research Projects Agency – Energy (ARPA-E).

Established in 2007 by the America COMPETES Act (P.L.110-69), ARPA-E is statutorily charged with developing energy technologies that result in "(i) reductions of imports of energy from foreign sources; (ii) reductions of energy-related emissions, including greenhouse gases; and (iii) improvement in the energy efficiency of all economic sectors." Initially provided with $400 million in American Recovery and Reinvestment Act (ARRA) (P.L.111-5) funding, ARPA-E did not receive a direct appropriation in FY10, though it was the beneficiary of a $15 million transfer from the Office of Science.

Of the $650 million request, $550 million would be provided through discretionary funding for the purpose of sponsoring additional rounds of project funding. Potential funding areas include stationary power, electrical infrastructure, end use efficiency, embedded efficiency, and transportation systems.

ARPA-E would also administer an additional $100 million Wireless Innovation Fund (WIN) aimed at developing clean-energy wireless technologies, paid for through a proposed transfer of wireless spectrum auction revenues. The Administration proposes to establish WIN as a mandatory program.

In 2010, ARPA-E issued $207.6 million in ARRA funds for 85 projects. The six program areas funded in 2010 included Electrofuels, Batteries for Electrical Energy Storage in Transportation (BEEST), Innovative Materials & Processes for Advanced Carbon Capture Technologies (IMPACCT), Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS), Agile Delivery of Electrical Power Technology (ADEPT), and Building Energy Efficiency Through Innovative Thermodevices (BEET-IT).

Fossil Energy R&D

The DOE Office of Fossil Energy (FE) supports R&D focused on coal (including clean coal technologies), gas, and petroleum and also supports the Federal government's Strategic Petroleum Reserve. The President's total budget request for FE is $520 million. Of that, FE's R&D budget is $453 million, a decrease of $206 million (31.3 percent) below FY10 enacted levels.

Coal R&D is funded at $291 million, the bulk of which focuses on advancing carbon capture and sequestration (CCS) efforts. Carbon capture research reprioritizes research from pre-combustion capture towards post-combustion technologies with the intention of advancing the development of commercial technology. The Carbon Storage subprogram is conducting large-volume injection testing to examine the feasibility of long-term carbon storage. The Hydrogen from Coal, Coal to Coal Biomass to Liquids, and Solid Oxide Fuel Cells subprograms are all eliminated.

The FY12 budget request proposes to terminate the Natural Gas Technologies and Unconventional Fossil Energy Technologies programs, including the elimination of $50 million for the Ultra-Deep and Unconventional Natural Gas Other Petroleum Resources Research Program.

Nuclear Energy (NE)

The primary mission of the Office of Nuclear Energy (NE) is to "advance nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration as appropriate."

The FY12 budget request for NE R&D is $447.4 million, a $39.6 million (8.1 percent) decrease below FY 2010 levels. Approximately 74 percent of that request would be dedicated to the Fuel Cycle R&D and Reactor Concepts RD&D programs. The Fuel Cycle R&D program conducts research on the three basic fuel cycle technologies: once-through, modified-open, and full recycle. The Reactor Concepts RD&D program continues previous activities undertaken by the Generation IV Nuclear Energy Systems program, including the Next Generation Nuclear Plant project. In addition, advanced Small Modular Reactor (SMR) designs would be examined.

As reflected in the Administration's FY 2011 budget request, NE proposes to create the Nuclear Energy Enabling Technologies (NEET) program. The $97.3 million program would investigate crosscutting technologies and transformative breakthroughs applicable to multiple reactor concepts and fuel cycle technologies. NEET would also support the Modeling and Simulation Energy Innovation Hub, which seeks to create a "virtual" reactor by applying existing modeling and simulation capabilities. This would utilize modeling as a means to improve efficiency in existing reactors as well as inform new reactor designs.

The budget also proposes a SMR Licensing Technical Support Program to partner with industry to accelerate development and licensing of SMRs necessary for commercial deployment.

Electricity Delivery and Energy Reliability

The mission of the Office of Electricity Delivery and Energy Reliability (OE) is to "lead national efforts to modernize the electric grid; enhance security and reliability of the energy infrastructure; and facilitate recovery from disruptions to energy supply." Research and Development within OE is funded at $193 million in the President's FY12 budget request. This reflects an increase of $71.4 million (58.8 percent) over FY10 levels.

OE's R&D programs focus on clean energy transmission and reliability, smart grid R&D, energy storage, and cyber security for energy delivery systems. OE concentrates on potential strains on the electric system as electric generation shifts towards low-carbon energy sources, specifically associated intermittency problems from wind and solar generation. The effects will require advanced grid modeling and extensive technological breakthroughs in energy storage. The President requests $20 million for the creation of a Smart Grid Technology and Systems Hub to be administered by OE within the Clean Energy Transmission and Reliability subprogram.

Also highlighted within the OE request is $57 million for the Energy Storage subprogram, a 319 percent increase above the FY 2010 level to support demonstrations for a new suite of grid level storage projects and further testing on prototype materials.

Loan Guarantee Program Office

The President's FY12 budget request for DOE's Loan Guarantee Program Office (LPO) is $200 million. Funds would be used as a credit subsidy for loans authorized under Section 1703 of the Energy Policy Act of 2005. The LPO did not receive an appropriation for credit subsidies in FY10. This level of appropriation would support an estimated $1 to $2 billion in loan guarantees to support energy efficiency and renewable energy activities.

Since its creation, the LPO has awarded over $17.6 billion for 18 projects, in a wide variety of areas such as solar and wind power generation and manufacturing, geothermal energy, and electricity transmission and energy storage.

In addition to the Title 17 loan guarantees, the President is requesting $105 million to create a Better Building Pilot Loan Guarantee Initiative for Universities, Schools, and Hospitals. This new program would fund loan guarantees to retrofit commercial buildings and would subsidize up to $2 billion in total loan principal.

Energy Innovation Hubs

The FY12 budget request proposes funding of $146 million for support six Energy Innovation Hubs, which are supported through the SC, EERE, and NE accounts. This would support the three existing Hubs and as well as the creation of three new Hubs, which the President highlighted in his recent State of the Union address. According to the Administration, Hubs are funded at approximately $25 million each annually and area intended to "advance highly promising areas of energy science and engineering from the early stage of research to the point where the technology can be handed off to the private sector."[2]

Existing Hubs include Fuels from Sunlight ($24.3 million, administered by the Office of Science, Basic Energy Services), Modeling & Simulation for Nuclear Reactors ($24.3 million, administered by the Office of Nuclear Energy), and Energy Efficient Building Systems Regional Innovation Cluster Initiative ($24.3 million, administered by EERE, Building Technologies Program)

The newly proposed Hubs are Batteries and Energy Storage ($34 million, administered by the Office of Science, Basic Energy Sciences), Smart Grid Technology and Systems ($19.4 million, administered by OE, Clean Energy Transmission and Reliability Program), and Critical Materials ($20 million administered by EERE, Industrial Technologies Program).

[2] http://www.energy.gov/hubs/