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

HEARING CHARTER

Department of Energy Science and Technology Priorities
Tuesday, June 18, 2013
10:15 a.m. – 12:15 p.m.
2318 Rayburn House Office Building

PURPOSE

The Committee on Science, Space, and Technology will hold a hearing entitled *Department of Energy Science and Technology Priorities* on Tuesday, June 18, at 10:00 a.m. in Room 2318 of the Rayburn House Office Building. The purpose of the hearing is to examine the Department of Energy's (DOE) science and technology priorities and related management and policy challenges, with an emphasis on how these factors influence research, development, demonstration and commercialization activities within the overall mission of the Department.

WITNESS LIST

Dr. Ernest Moniz, *Secretary of Energy, U.S. Department of Energy.* Dr. Moniz was unanimously confirmed as the 13th Secretary of Energy by the Senate on May 16, 2013. Prior to his appointment, Dr. Moniz was a Professor of Physics and Engineering Systems at the Massachusetts Institute of Technology (MIT), and served as founding Director of the MIT Energy Initiative.

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, nuclear safety and security, scientific discovery and innovation, environmental responsibility, and management and operational excellence.

[1] All DOE mission statements are cited from that office's website.

Department of Energy (DOE) Science and Technology Spending

(dollars in millions)

Program	FY 2012 Current	FY 2013 Annualized CR	FY 2014 Request	FY 2014 Request versus FY 2012 Enacted	
				$	%
Office of Science					
Advanced Scientific Computing Research	*428.3*	*443.6*	*465.6*	*37.3*	*8.7*
Basic Energy Sciences	*1644.8*	*1698.4*	*1862.4*	*217.6*	*13.2*
Biological and Environmental Research	*592.4*	*613.3*	*625.3*	*32.9*	*5.6*
Fusion Energy Sciences	*393.0*	*403.5*	*458.3*	*65.3*	*16.6*
High Energy Physics	*770.5*	*795.7*	*776.5*	*6.0*	*0.8*
Nuclear Physics	*534.6*	*550.7*	*569.9*	*35.3*	*6.6*
Office of Science*	***4873.6***	***4903.5***	***5152.8***	***279.2***	***5.7***
Energy Efficiency and Renewable Energy (EERE)					
Hydrogen and Fuel Cell Technologies	*101.3*	*104.3*	*100.0*	*(1.3)*	*(1.3)*
Bioenergy Technology	*195.0*	*200.5*	*282.0*	*81.5*	*40.6*
Solar Energy	*284.7*	*290.7*	*356.5*	*71.8*	*25.2*
Wind Energy	*91.8*	*93.8*	*144.0*	*52.2*	*56.9*
Geothermal Technology	*37.0*	*38.1*	*60.0*	*23.0*	*62.2*
Water Power	*58.1*	*59.1*	*55.0*	*(3.1)*	*(5.3)*
Vehicle Technologies	*321.0*	*330.8*	*575.0*	*254.0*	*79.1*
Building Technologies	*214.7*	*220.5*	*300.0*	*85.3*	*39.7*
*Advanced Manufacturing****	*112.7*	*116.3*	*365.0*	*248.7*	*213.9*
Energy Efficiency and Renewable Energy (EERE)*	**1780.1**	**1820.7**	**2775.7**	**995.6**	**55.9**
Race to the Top for Energy Efficiency/Grid Modernization	**0**	**0**	**200.0**	**200.0**	**n/a**
Energy Security Trust	**0**	**0**	**200.0**	**200.0**	**n/a**
Nuclear Energy**	**760.5**	**770.1**	**735.5**	**(25.0)**	**(3.3)**
Electricity Delivery and Energy Reliability R&D	**136.2**	**140.0**	**169.0**	**32.8**	**24.1**
Fossil Energy R&D	**337.1**	**495.0**	**420.6**	**83.5**	**24.8**
ARPA-E	**275.0**	**276.7**	**379.0**	**104.0**	**37.8**
Loan Guarantee Program Office	**38.0**	**0**	**48.0**	**10.0**	**26.3**
Totals:	**8418.2**	**8625.0**	**10298.0**	**1879.8**	**22.3**

*Total program funding; minor and non-S&T accounts at SC and EERE are not shown.

** Total Office of Nuclear Energy; includes Facility Management and Idaho Safeguards and Security

DOE's Fiscal Year (FY) 2014 budget request seeks funding to achieve the Administration's energy policy goals: reducing oil dependency by 2 million barrels a day by 2025 and cutting oil imports in half by 2020; doubling renewable electricity production from wind, solar, and geothermal by 2020; and doubling energy productivity by 2030.[2] In support of these goals, the request includes investments in the research, development, demonstration, and deployment (RDD&D) of clean energy technologies, as well as investments that lead to a reduction in dependence in oil and mitigate the impact of climate change.[3]

The overall FY 2014 budget request for DOE is $28.4 billion, which represents a $2.1 billion or 6.2 percent increase over FY 2012 levels.[4] 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 primarily allocated to the National Nuclear Security Administration (NNSA), to maintain our stockpile of nuclear materials, 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 (SC)

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. The FY 2014 budget request for the Office of Science (SC) is $5.2 billion, a $218 million or 4.4 percent increase over the FY 2012 levels. Funding for SC is spread across four priority goal areas: 44% for research; 40% for facility operations; 15% for future facilities; and 1% for workforce development.

The Office of Science is the largest Federal sponsor of basic research in the physical sciences, and supports 31 national scientific user facilities.[5] SC supports research programs and user facilities that include support for three Bioenergy Research Centers (BRCs), 46 Energy Frontier Research Centers (EFRCs), and two Energy Innovation Hubs.

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 approximately 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.

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[2] Department of Energy, *FY 2014 Budget Request, Budget Highlights,* P. 1, April 2013, Accessible at: http://energy.gov/sites/prod/files/2013/04/f0/Highlights.pdf

[3] Ibid.

[4] Ibid.

[5] For a list of SC-supported National User Facilities see: U.S. Department of Energy, Office of Science User Facilities, FY 2013. Accessible at: http://science.energy.gov/~/media/_/pdf/user-facilities/Office_of_Science_User_Facilities_FY_2013.pdf

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

- **Basic Energy Sciences (BES)** supports fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels and maintains world-class research facilities to develop facilitate advances in material science and chemistry.
- **Biological and Environmental Research (BER)** supports fundamental research focused on biological systems, climate, and environmental sciences, including work in genomics, climate change, and advanced environmental issues. The request also includes support for the three DOE Bioenergy Research Centers, the Joint Genome Institute, and Environmental Molecular Sciences Laboratory.
- **Advanced Scientific Computing Research (ASCR)** supports research to discover, develop, and deploy computational and networking capabilities. Funding is requested to position the Department to address scientific challenges that require 1,000 fold increases in computing capability and scientific data.
- **Fusion Energy Sciences (FES)** supports research to improve fundamental understanding of matter at very high temperatures and densities needed to develop fusion energy.
- **High Energy Physics (HEP)** probes the basic relationship between space and time, the elementary constituents of matter and energy, and the interactions between them. This effort focuses on three scientific frontiers: the energy frontier, the intensity frontier, and the cosmic frontier.
- **Nuclear Physics (NP)** supports research to discover and understand various forms of nuclear matter, as well as the production and development of techniques to make isotopes needed for medical, national security, environmental, and other research applications.

Energy Efficiency and Renewable Energy (EERE)

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." In FY 2014, EERE requests $2.8 billion, an increase of $995 million or 56 percent above FY 2012 levels.

EERE seeks to ensure American leadership in the transition to a clean energy economy, which the Office attempts to achieve through focused RDD&D investments on activities in the following areas: sustainable transportation ($957 million), renewable electricity ($616 million), and end-use energy efficiency in buildings and factories ($949 million).

EERE programs also emphasize cross-cutting initiatives, including: the EV[6] Everywhere Grand Challenge, Clean Energy Manufacturing Initiative, SunShot Grand Challenge, EERE Grid Integration Initiative, and Wide Bandgap Semiconductors for Clean Energy Initiative. Specific EERE sub-programs include:

- **Bioenergy Technologies** 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.

[6] EV stands for Electric Vehicles

- **Solar Energy** supports the Department's SunShot Initiative's mission to make solar energy technologies cost-competitive without subsidies with fossil fuels by 2020.
- **Wind Energy** supports the widespread deployment of wind energy by investing in wind energy research, development, demonstration, and deployment for offshore, onshore, and distributed wind generation. The program goal is to make wind energy cost-competitive with other sources of electricity without subsidies.
- **Water Power** supports development of new water power technologies and accelerates deployment of existing hydropower technologies. The program supports both hydropower resources and marine and hydrokinetic resources.
- **Hydrogen and Fuel Cell Technologies** mission is to enable the widespread commercialization of hydrogen and fuel cell technologies.
- **Vehicle Technologies Program (VTP)** supports research to improve transportation efficiency, develop advanced batteries, and improve electric vehicle technology. VTP supports the EV Everywhere Grand Challenge; the Workplace Charging Challenge, which aims for a tenfold increase in employers offering workplace charging options; and the Alternative Fuel Community Partner Projects, which aims to encourage the use of alternative fuels, such as natural gas, through the leveraging of community-based government-industry partnerships.
- **Geothermal Technologies** addresses technical challenges that affect the development of undiscovered hydrothermal resources and Enhanced Geothermal Systems through targeted RDD&D.
- **Advanced Manufacturing Office (AMO)** supports the mission to "develop and demonstrate new, energy-efficiency processing and materials technologies and a scale adequate to prove their value to manufacturers and spur investment." AMO develops broadly applicable manufacturing processes and new pervasive materials technologies. AMO supports the Clean Energy Manufacturing Initiative (CEMI), a new cross-cutting activity anchored in AMO and will include involvement and dedicated funding across several EERE programs.
- **Building Technologies** supports the development and promotion of efficient, environmentally friendly, and affordable technologies, systems, and practices for residential and commercial buildings, with the long-term goal of reducing building-related energy usage 50% by 2030. The program also administers the Energy Efficient Buildings Systems Design Hub, and supports the ENERGY STAR program.

In his FY14 budget request, the Administration also proposed creation of two major new initiatives related to energy efficiency and renewable energy: (1) $200 million for the Race to the Top for Energy Efficiency and Grid Modernization; and (2) $200 million in FY14 ($2 billion over ten years) for an "Energy Security Trust" that would support research on transportation alternatives, including "advanced vehicles that run on electricity, homegrown biofuels, and domestically produced natural gas."[7] While the Administration has not specified which DOE office would administer these programs, the proposed activities appear most aligned with EERE programs and activities.

[7] http://www.whitehouse.gov/the-press-office/2013/03/15/fact-sheet-president-obama-s-blueprint-clean-and-secure-energy-future

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

ARPA-E was established in 2007 by the America COMPETES Act (P.L.110-69), and 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." The mission of ARPA-E is to support innovations in energy technology that enhance economic and energy security, reduce energy imports, improve energy efficiency, and ensure the U.S. leads in technological innovation. The program focuses exclusively on high-impact innovations that aim to translate science into breakthrough technologies. In FY 2014, ARPA-E requests $379 million, an increase of $104 million or 38 percent above FY 2012 levels.

Fossil Energy R&D (FE)

The DOE Office of Fossil Energy (FE) supports R&D focused on coal (including clean coal technologies), gas, and petroleum, and supports the Federal Government's Strategic Petroleum Reserve. FE R&D activities request $421 million for FY 2014, an increase of $83 million or 25 percent over FY 2012 levels.

DOE coal initiatives consist of Carbon Capture and Storage (CCS) demonstration programs, which were funded primarily through the American Recovery and Reinvestment Act, and carbon capture and storage and power systems R&D activities. The DOE CCS demonstration program includes a total of eight projects administered by the Clean Coal Power Initiative (four projects), the Industrial Carbon Capture and Storage program (three projects), and FutureGen 2.0.

FE's Natural Gas Technologies R&D program supports an new interagency R&D initiative started in FY 2013 between DOE, the Environmental Protection Agency, and the U.S. Geological Survey to "understand and minimize the potential environmental, health, and safety impacts of shale gas development through hydraulic fracturing" including the key research recommendations received from the Subcommittee of the Secretary of Energy Advisory Board.[8]

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." NE requests a total of $735.5 million for FY 2014, a decrease of $118.4 million or 14 percent below FY 2012 levels.

Nuclear energy R&D activities are primarily divided into four programs: SMR Licensing Technical Support, Reactor Concepts Research, Development and Demonstration, Fuel Cycle Research and Development, and Nuclear Energy Enabling Technologies, which funds

[8] DOE Budget Highlights, p. 34.

crosscutting nuclear research initiatives. NE also provides significant funding for nuclear research conducted at Idaho National Laboratory, NE's primary research facility.

Electricity Delivery and Energy Reliability (OE)

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 includes Clean Energy Transmission and Reliability, Smart Grid, Energy Storage, Cybersecurity for Energy Delivery Systems, and the Electricity Systems Hub. Total funding requested for these activities is $119.4 million, an increase of $23.2 million or 24.1 percent over FY 2012. OE concentrates R&D activities on addressing potential strains on the electric system as electric generation shifts towards low-carbon energy sources, specifically associated intermittency problems from wind and solar generation.

Loan Guarantee Program Office (LPO)

Title 17 of the Energy Policy Act of 2005 authorizes DOE to make loan guarantees to encourage early commercial use of new or significantly improved technologies in energy projects. Projects supported must avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases; employ new or significantly improved technologies; and offer a reasonable prospect of repayment of the principal and interest on the guaranteed obligation.

The mission of the LPO is to "accelerate the domestic commercial deployment of innovative and advanced clean energy technologies at a scale meaningful to contribute meaningfully to our national clean energy objectives."[9] The LPO executes this mission by guaranteeing loans to eligible clean energy projects and providing direct loans to eligible manufacturers of advanced technology vehicles and components. Recipients of DOE loan guarantees include the Caithness Shepherds Flat wind project[10] (the world's largest wind farm), NRG's Agua Caliente solar farm[11], a 290 MW commercial-scale photovoltaic solar plant, and Abengoa's Bioenergy Biomass[12], a commercial-scale biofuel plant, among others.

LPO has closed, or awarded, over $16 billion in loan guarantees for 26 renewable energy projects, and has made additional conditional commitments totaling more than $10 billion which have not yet closed. The FY 2014 budget request is $48 million for administrative expenses, which will "enable LPO to continue active monitoring of closed projects while increasing efforts to deploy the existing $34 billion in loan authority and $169 million in credit subsidy appropriations for clean energy technologies."[13]

[9] Loan Program Office, Accessible at: http://lpo.energy.gov/about/our-mission/
[10] http://lpo.energy.gov/?projects=caithness-shepherds-flat
[11] http://lpo.energy.gov/?projects=agua-caliente
[12] http://lpo.energy.gov/?projects=abengoa-bioenergy-biomass-of-kansas-llc
[13] Ibid, p. 49