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

HEARING CHARTER

Department of Energy Science and Technology Priorities
Thursday, April 10, 2014
9:00 a.m. – 11:00 a.m.
2318 Rayburn House Office Building

PURPOSE

The Committee on Science, Space, and Technology will hold a hearing titled *"Department of Energy Science and Technology Priorities"* on Thursday, April 10, 2014, at 9:00 a.m. in Room 2318 of the Rayburn House Office Building. With the release of the President's budget request for fiscal year (FY) 2015, the purpose of the hearing is to examine the Department of Energy's (DOE) science and technology priorities, emphasizing how these factors influence research, development, demonstration and commercialization activities and budgets within the overall mission of the Department.

WITNESS LIST

- **The Honorable Ernest Moniz**, *Secretary of Energy, U.S. Department of Energy*

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.

The President's FY 2015 budget request for DOE is $27.9 billion, which represents a $715.6 million or 2.6 percent increase over FY 2014 omnibus levels.[2] 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 a stockpile of nuclear materials and Defense and Non-Defense Environmental Management (EM) programs.

[1] All DOE mission statements are cited from that office's website. *See generally* www.energy.gov.
[2] Ibid.

The following table provides a breakdown of the DOE budget request within the Science Committee's jurisdiction:

Department of Energy (DOE) Science and Technology Spending (dollars in millions)				
Program	**FY 2013 Enacted**	**FY 2014 Enancted**	**FY 2015 Request**	**FY 2015 vs FY 2014 (% Change)**
Office of Science (SC)	**4,903.5**	**5,066.4**	**5,111.2**	**0.9%**
Advanced Scientific Computing Research	443.6	478.1	541.0	13.2%
Basic Energy Sciences	1,698.4	1,711.9	1,806.5	5.5%
Biological and Environmental Research	613.3	609.7	628.0	3.0%
Fusion Energy Sciences	403.5	504.7	416.0	-17.6%
High Energy Physics	795.7	796.5	744.0	-6.6%
Nuclear Physics	550.7	569.1	593.6	4.3%
Workforce Development for Teachers and Scientists	18.6	26.5	19.5	-26.4%
Science Laboratories Infrastructure	112.5	97.8	79.2	-19.0%
Safeguards and Security	81.1	87.0	94.0	8.0%
Science Program Direction	186.1	185.0	189.4	2.4%
Energy Efficiency and Renewable Energy (EERE)	**1,820.7**	**1,900.6**	**2,316.7**	**21.9%**
Electricity Delivery and Energy Reliability (OE)	**140.0**	**147.2**	**180.0**	**22.2%**
Nuclear Energy (NE)	**770.1**	**888.4**	**863.4**	**-2.8%**
Fossil Energy (NE)	**495.0**	**561.9**	**475.5**	**-15.4%**
Advanced Research Projects Agency - Energy (ARPA-E)	**276.7**	**280.0**	**325.0**	**16.1%**
Loan Guarantee Program Office	**5.7**	**26.0**	**11.0**	**-57.7%**
Total	**8,411.5**	**8,870.6**	**9,282.8**	**4.6%**

This budget request claims to meet the Administration's goals of funding technological solutions to further their energy and nuclear security goals. While endorsing an all-of-the-above energy strategy, the President's Budget seeks to have "the Nation lead the global effort to combat climate change while creating U.S. jobs." The budget request also pays for environmental cleanup and to secure nuclear and radiological materials around the world.[3]

Secretary Moniz has also reorganized the management of DOE into three Secretariats — Science and Energy, Nuclear Security, and Management and Performance, each with an Undersecretary in charge. Important questions and key issues to be discussed at the hearing include:

[3] Department of Energy, *FY 2015 Budget Request, Budget Highlights,* P. 1, March 2014, Accessible at: http://www.energy.gov/sites/prod/files/2014/03/f13/15Highlights%20%281%29.pdf

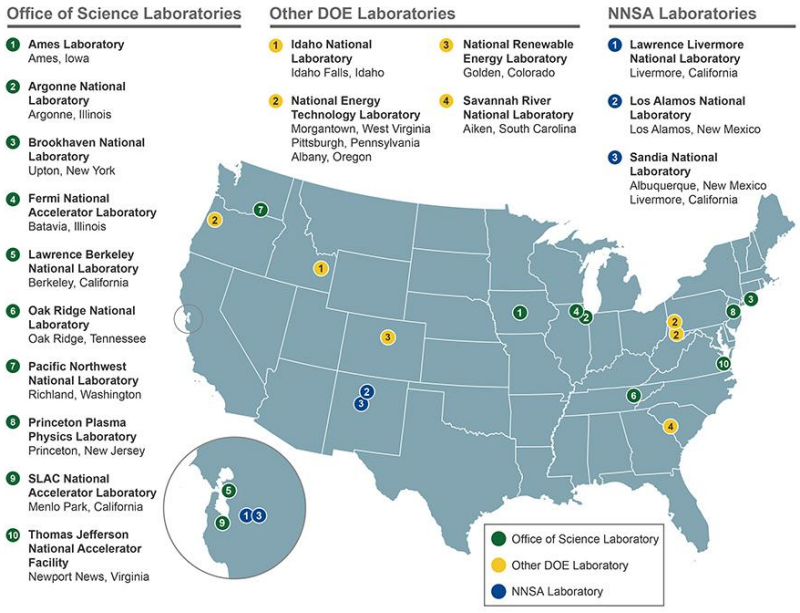
- The role of government when picking winners and losers for companies, types of energy sources, and technologies in the energy sector;
- The Administration's priorities for the development of renewable energy at the expense of basic research; and
- The performance of the DOE loan guarantee program compared to other sources for funding.

DOE R&D PROGRAMS AND OFFICES

Office of Science (SC)

The mission of the Office of Science is "to deliver scientific discoveries and major scientific tools that transform our understanding of nature and advance the energy, economic, and national security of the United States."[4] The FY 2015 budget request for the Office of Science (SC) is $5.1 billion, a $44.8 million or 0.9 percent increase over the FY 2014 appropriations. Funding for SC is spread across four priority goal areas: 75% for research; 15% for facility operations; 9.6% for future facilities; and 0.4% for workforce development. SC has grown at an annualized 3.7% from 2008 to 2014.

The Office of Science is the largest Federal sponsor of basic research in the physical sciences, and supports 31 national scientific user facilities, many of which are operated by the national labs (see a map of the labs below).[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.



[4] [4] Department of Energy, *FY 2015 Budget Request, Science, Advanced Research Project Agency-Energy*. P. 1, March 2014, Accessible at http://energy.gov/sites/prod/files/2014/04/f14/Volume_4.pdf

[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 to provide the foundations for new energy technologies, to mitigate the environmental impacts of energy use, and to support DOE missions in energy, environment, and national security.

- **Biological and Environmental Research (BER)** includes efforts to understand how genomic information is translated to functional capabilities, enabling more confident redesign of microbes and plants for sustainable biofuels production, improved carbon storage, and contaminant bioremediation. BER research advances our understanding of the role of atmospheric, terrestrial, ocean, and subsurface interactions in determining climate dynamics to predict future climate change and plan for future energy and resource needs.

- **Advanced Scientific Computing Research (ASCR)** supports advanced computational research, applied mathematics, computer science, and networking as well as development and operation of multiple, large high performance computing facilities.

- **Fusion Energy Sciences (FES)** supports research to understand the behavior of matter at high temperatures and densities, and to develop fusion as a future energy source.

- **High Energy Physics (HEP)** supports research to understand how the universe works at its most fundamental level by discovering the most elementary constituents of matter and energy, probing the interactions among them, and exploring the basic nature of space and time.

- **Nuclear Physics (NP)** supports research to discover, explore, and understand nuclear matter in a variety of different forms.

Energy Efficiency and Renewable Energy (EERE)

The Office of Energy Efficiency and Renewable Energy (EERE) is "the U.S. Government's Primary clean energy technology organization" that works to "support high-impact applied research, development, demonstration, and deployment (RD&D) activities."[6] The DOE budget for FY 2015 requests $2.3 billion for EERE, an increase of $416 million or 22 percent over FY 2014 appropriations levels.

EERE proposes to ensure American leadership in the transition to a clean energy economy through research, development, demonstration and deployment (or RDD&D) in activities in the following areas: sustainable transportation ($705.2 million), renewable electricity ($521.3 million), and end-use energy efficiency in buildings and factories ($857.7 million).

[6] Department of Energy, *FY 2015 Budget Request, Energy Programs.* P. 11, March 2014, Accessible at http://energy.gov/sites/prod/files/2014/04/f14/Volume%203.pdf

EERE programs also emphasize cross-cutting initiatives, including: *Grid Integration Initiative, Clean Energy Manufacturing Initiative (CEMI), Next Generation Power Electronics Initiative, Carbon Fiber Composites for Clean Energy Initiative*. Specific EERE sub-programs include:

- **Bioenergy Technologies.** EERE requests $253.2 million (9 percent increase) in FY 2015, with an emphasis on the development of innovative processes to convert cellulosic and algal-based feedstocks to bio-based gasoline, jet, and diesel fuels. It proposes commercial scale demonstration for military-specification fuels with the U.S. Departments of Navy and Agriculture.

- **Solar Energy.** EERE requests $282.3 million (a 9.82 percent increase) in FY 2015 to support the SunShot Initiative goal to make solar power cost competitive without subsidies by 2020. This includes the development and demonstration of manufacturing technologies to increase U.S. competitiveness, in support of DOE's Clean Energy Manufacturing Initiative, and solar photovoltaic activities that enable both hardware development and a 50 percent reduction in non-hardware "soft costs".

- **Water Power.** EERE requests $62.5 million (a 6.72 percent increase) in FY 2015 to support innovative technologies for generating electricity from water resources. HydroNEXT, a new EERE initiative, aims to improve the performance, flexibility, and environmental sustainability of technologies applicable to existing hydropower facilities, while also developing and demonstrating technologies that will enable new hydropower development.

- **Wind Energy.** EERE requests $115 million (a 30.49 percent increase) in FY 2015 to fund three advanced offshore wind demonstration projects, as well as an Atmosphere to Electrons Initiative focused on optimizing whole wind farms as a system to lower costs. FY 2015 funding also enables pursuit of new designs, materials and manufacturing processes for longer blades to capture more wind resource and to address energy storage and transmission barriers in support of DOE's Clean Energy Manufacturing Initiative.

- **Hydrogen and Fuel Cell Technologies.** EERE requests $93 million (a 0.06 percent increase) in FY 2015 to support a focused R&D effort to reduce the cost and increase the durability of fuel cell systems. Hydrogen Fuel R&D proposes to work on technologies and materials that will reduce hydrogen production, compression, transport, and storage costs. The request also proposes to support targeted early market fuel cell demonstrations and addresses codes and standards to overcome barriers to commercialization.

- **Vehicle Technologies Program (VTP).** EERE requests $359 million (a 23.91 percent increase) in FY 2015 to support RDD&D of efficient and alternative fuel vehicles. A number of vehicle technology goals are planned: battery energy storage, electric drive research and development, and advanced power electronics initiatives in support of the EV

Everywhere Grand Challenge[7]; improvements in lightweight materials performance; more efficient combustion engine technologies; and alternative fuel vehicle community partner projects. The alternative fuel vehicle community partner projects are competitively-awarded to build strategically-placed, high-impact, community-scale demonstrations of alternative fuel vehicles.

- **Geothermal Technologies.** EERE requests $61.5 million (a 34.35 percent increase) in FY 2015, including support for site characterization of the Frontier Observatory for Research in Geothermal Energy (FORGE). FORGE is a dedicated site that enables testing of technologies and techniques, with a central focus on Enhanced Geothermal Systems optimization and validation.[8] FY 2015 funding also accelerates "play fairway" analyses, which provide assessments of exploration risk and the probability of finding new resources on a regional scale, resulting in maps and studies that reduce drilling and development risks.

- **Advanced Manufacturing Office (AMO).** EERE requests $305.1 million (a 69.06 percent increase) in FY 2015 to support the deployment of at least one additional Clean Energy Manufacturing Innovation Institute, along with continued support of existing institutes. The FY 2015 funding request also seeks to support high-impact R&D focused on advanced manufacturing and materials that will enable U.S. manufacturers to realize significant gains in energy productivity, environmental performance, product yield, and economic competitiveness. The request also plans to support high-impact R&D focused on advanced manufacturing and materials with U.S. manufacturers to realize significant gains in energy productivity, environmental performance, and product yield.

- **Building Technologies** EERE requests $211.7 million (a 19.02 percent increase) in FY 2015 to accelerate the development of lighting, heating and cooling, and other energy efficiency solutions for buildings and supporting the equipment and appliance standards programs, to establish minimum energy efficiency requirements pursuant to federal regulations. The FY 2015 funding request plans to assist home builders achieve higher efficiency levels, improve access for homeowners to home improvement services, and improve the information, tools, and resources available to the commercial sector with a goal of achieving 20 percent energy savings by 2020.

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

ARPA-E was established in 2007 by the America COMPETES Act (P.L.110-69), and is 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

[7] For more information on the EV Everywhere Grand Challenge: http://www1.eere.energy.gov/vehiclesandfuels/electric_vehicles/index.html

[8] For more information on FORGE: http://www1.eere.energy.gov/geothermal/news_detail.html?news_id=21286

innovation. The program focuses exclusively on high-impact innovations that aim to translate science into breakthrough technologies. In FY 2015, ARPA-E requests $325 million, an increase of $40 million or 16 percent above FY 2014 appropriations.

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 $475.5 million for FY 2015, a decrease of $86.4 million or -15.4 percent from FY 2014 appropriations.

Fossil Energy Research and Development (FE R&D) advances technologies related to the reliable, efficient, affordable, and environmentally sound use of fossil fuels. FE leads Federal research, development, and demonstration efforts on advanced carbon capture, and storage (CCS) technologies to facilitate achievement of the President's climate goals. FE also develops technological solutions for development of our unconventional domestic resources.[9]

The Natural Gas Technologies focuses on technologies to reduce the carbon footprint, emissions, and water use of unconventional domestic natural gas resources. The Department of Energy, Department of the Interior, and Environmental Protection Agency are engaged in an inter-agency taskforce to address challenges associated with developing unconventional resources. FE R&D includes advancements in technology, methodology, risk assessment, and mitigation.

Nuclear Energy (NE)

The primary mission of the Office of Nuclear Energy (NE) is to support the diverse civilian nuclear energy programs of the U.S. Government, and Federal efforts to research and develop nuclear energy technologies, including generation, safety, waste storage and management, and security technologies, to help meet energy security, proliferation resistance, and climate goals. NE requests a total of $863.4 million for FY 2015, a decrease of $25.0 million or 2.8 percent below FY 2014 appropriations.

Nuclear energy R&D activities are primarily divided into four programs: SMR Licensing Technical Support, Supercritical Transformational Electric Power Generation, Reactor Concepts Research, Development and Demonstration, Fuel Cycle Research and Development, and Nuclear Energy Enabling Technologies, which funds crosscutting nuclear research initiatives. NE also provides significant funding for Radiological Facilities Management, International Nuclear Energy Cooperation and Idaho Facilities Management and Idaho Sitewide Safeguards and Security.

Electricity Delivery and Energy Reliability (OE)

The mission of the Office of Electricity Delivery and Energy Reliability is electric grid modernization and resiliency in energy infrastructure through research, demonstration,

[9] DOE Budget Highlights, p. 28.

partnerships, facilitation, modeling and analytics, and emergency preparedness and response. OE is the Federal government's energy sector-specific lead in responding to energy security emergencies, both physical and cyber. OE also plays a critical role in implementation of the President's Climate Action Plan to mitigate the risks and enhance resilience against climate change. The FY 2015 Request emphasizes increased electric grid resilience, manage risks, increase system flexibility and robustness, increase visualization and situational awareness, and deployment of advanced control capabilities. OE also conducts R&D activities in addressing the strains of intermittent generation from wind and solar power sources on the electric system.

Total funding requested for these activities is $180.0 million, an increase of $32.8 million or 22.3 percent over FY 2014 appropriations.

Loan Guarantee Program Office (LPO)

Title 17 of the Energy Policy Act of 2005 authorizes DOE to make loan guarantees to encourage early commercial energy projects which 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."[10] 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.

The FY 2015 budget request is $7 million for administrative expenses, which will enable LPO to continue active monitoring of closed projects, a decrease of $13 million or 65% of FY 2014 level.

[10] Loan Program Office, Accessible at: http://lpo.energy.gov/about/our-mission/