

**AN OVERVIEW OF THE BUDGET PROPOSAL
FOR THE DEPARTMENT OF ENERGY
FOR FISCAL YEAR 2016**

HEARING
BEFORE THE
**COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY**
HOUSE OF REPRESENTATIVES
ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

FEBRUARY 25, 2015

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WEDNESDAY, FEBRUARY 25, 2015

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

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

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Full Committee

***An Overview of the Department of Energy's Budget Proposal for Fiscal
Year 2016***

Wednesday, February 25, 2015

10:00 a.m. – 12:00 p.m.

2318 Rayburn House Office Building

Witness

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

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

HEARING CHARTER

An Overview of the Department of Energy's Budget Proposal for Fiscal Year 2016

Wednesday, February 25, 2015

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 titled *An Overview of the Department of Energy's Budget Proposal for Fiscal Year 2016* on Wednesday, February 25, 2015, at 10:00 a.m. in Room 2318 of the Rayburn House Office Building. With the release of the President's budget request for fiscal year (FY) 2016, the purpose of the hearing is to examine the Department of Energy's science and technology priorities and their impact on the allocation of funding within the Department's research, development, demonstration, and commercialization activities.

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 "ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions."¹ A system of 17 national laboratories, overseen by the Department, is DOE's core resource for carrying out this mission.

The President's FY 2016 budget request for DOE is \$29.9 billion, which represents an increase of \$2.5 billion or 9.2 percent over FY 2015 enacted levels.² Approximately one-third of this amount is dedicated to science and energy programs within the Committee on Science, Space, and Technology's jurisdiction. The remainder of DOE's funding is allocated to the National Nuclear Security Administration (NNSA) to maintain a stockpile of nuclear materials and ongoing Defense and Non-Defense Environmental Management (EM) programs.

¹ Department of Energy Mission Statement. Available at <http://energy.gov/mission>.

² Department of Energy *FY 2016 Congressional Budget Request: Budget in Brief*, February 2, 2015, Available at <http://www.energy.gov/sites/prod/files/2015/02/f19/FY2016BudgetinBrief.pdf>

The following table provides a breakdown of the DOE budget request within the Science Committee's jurisdiction:³

Department of Energy (DOE) Science and Technology Spending (dollars in millions)				
Program	FY 2014 Enacted	FY 2015 Enacted	FY 2016 Request	FY 2016 vs FY 2015 (% Change)
Office of Science (SC)	5,066.4	5,067.7	5,339.8	5.4%
Advanced Scientific Computing Research	478.1	541.0	621.0	14.8%
Basic Energy Sciences	1,711.9	1,733.2	1,849.3	6.7%
Biological and Environmental Research	609.7	592.0	612.4	3.4%
Fusion Energy Sciences	504.7	467.5	420.0	-10.2%
High Energy Physics	796.5	766.0	788.0	2.9%
Nuclear Physics	569.1	595.5	624.6	4.9%
Workforce Development for Teachers and Scientists	26.5	19.5	20.5	5.1%
Science Laboratories Infrastructure	97.8	79.6	113.6	42.7%
Safeguards and Security	87.0	93.0	103.0	10.8%
Science Program Direction	185.0	183.7	187.4	2.0%
Energy Efficiency and Renewable Energy (EERE)	1,900.6	1,914.2	2,723.0	42.3%
Electricity Delivery and Energy Reliability (OE)	147.2	147.0	270.1	83.8%
Nuclear Energy (NE)	888.4	833.4	907.6	8.9%
Fossil Energy R&D (FER&D)	561.9	560.6	560.0	-0.1%
Advanced Research Projects Agency - Energy (ARPA-E)	280.0	280.0	325.0	16.1%
Total	8,844.6	8,802.9	10,125.5	15.0%

This budget request claims to meet the Administration's goals of funding technological solutions to further energy and nuclear security research and development. While endorsing an all-of-the-above energy strategy, the President's budget seeks to "innovate across a diverse portfolio of clean energy technologies to enhance economic competitiveness and secure America's long-term energy security and infrastructure," and continues to reference the President's Climate Action Plan (CAP) as the guide for emphasizing clean energy research, development, and deployment.⁴

In addition to continuing the reorganization of the Department into three Under Secretariats (Energy and Science, Nuclear Security, and Management and Performance) as

³ Department of Energy *FY 2016 Congressional Budget Request: Budget in Brief*, February 2, 2015, Available at <http://www.energy.gov/sites/prod/files/2015/02/f19/FY2016BudgetinBrief.pdf>

⁴ *Ibid.*

proposed in the FY 2015 budget request, the FY 2016 request includes over \$1.2 billion in crosscutting initiatives funded across the Science and Energy programs in the Department, advancing technology areas with multiple energy resource applications and institutionalizing coordination between program offices and the National labs. Initiatives include exascale computing, grid modernization, subsurface technology and engineering, supercritical CO₂, cybersecurity, and the energy-water nexus.⁵

Important questions and key issues to be discussed at the hearing include:

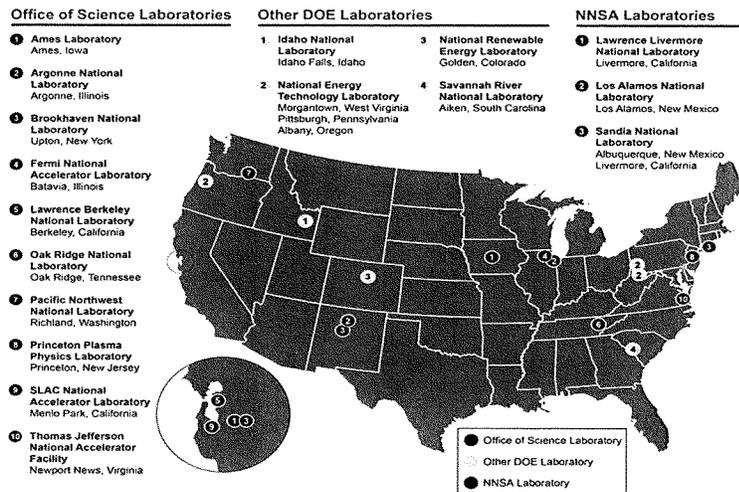
- How effectively does fundamental research and development within the Department of Energy's Office of Science lead to transformative scientific breakthroughs?
- Given the emphasis on renewable energy development within the Department compared to fossil and nuclear energy, are the strategic goals of the DOE's energy research programs aligned to the long-term energy needs of the American economy?
- How will key management, structure, and policy changes outlined in the request to Congress more efficiently and effectively advance the science and energy research and development conducted throughout DOE?
- The broader role of government in research and development, particularly the balance of investments between basic research versus applied energy development and demonstration.

⁵ Department of Energy *FY 2016 Congressional Budget Request: Volume 2*, p. 209, February 2, 2015, Available at <http://www.energy.gov/sites/prod/files/2015/02/f19/FY2016BudgetVolume2.pdf>

ADDITIONAL BACKGROUND: DOE R&D PROGRAMS AND OFFICES

Office of Science (SC)

The Office of Science is the “largest federal sponsor of basic research in the physical sciences, supporting 22,000 researchers at 17 National Laboratories and more than 300 universities.”⁶ The FY 2016 budget request for the Office of Science (SC) is \$5.34 billion, an increase of \$272 million or 5.4 percent over the FY 2015 enacted levels.



The Office of Science budget is divided into six major program areas:⁷

- **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. Funding for this program includes support for Energy Frontier Research Centers (EFRs), the Batteries and Energy Storage Energy Innovation Hub, and Computational Materials Sciences activities. BES is funded at \$1.85 billion, \$116 million above the FY 2015 enacted levels.

⁶ Department of Energy *FY 2016 Congressional Budget Request: Budget in Brief*, p. 3, February 2, 2015, Available at <http://www.energy.gov/sites/prod/files/2015/02/f19/FY2016BudgetinBrief.pdf>

⁷ Department of Energy *FY 2016 Congressional Budget Request: Volume 4*, February 2, 2015, Available at http://www.energy.gov/sites/prod/files/2015/02/f19/FY2016BudgetVolume4_5.pdf

- **Biological and Environmental Research (BER)** supports research on complex biological, climatic, and environmental systems, core research in genomic science, and efforts to advance 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. Funding for this program supports three DOE Bioenergy Research Centers (BRC). BER is funded at \$612 million, \$20 million above the FY 2015 enacted levels.
- **Advanced Scientific Computing Research (ASCR)** supports advanced computational research, applied mathematics, computer science, and networking and the development and operation of high performance computing facilities. Funding is specifically included to accelerate development of capable exascale computing systems, with ASCR serving as the lead office in the supercomputing crosscut identified within the budget request. ASCR is funded at \$621 million, \$80 million above the FY 2015 enacted levels.
- **Fusion Energy Sciences (FES)** supports research to understand the behavior of matter at high temperatures and densities and continue to develop fusion as a future energy source. Funding is also included for the U.S. contribution to the International Thermonuclear Experimental Reactor (ITER) project. FES is funded at \$420 million, \$48 million below the FY 2015 enacted levels.
- **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, their interactions, and the basic nature of space and time. Funding for this program supports activities and projects based on the strategic plan issued by the High Energy Physics Advisory Panel (HEPAP) in May 2014, including design support for reconfigured international Long Baseline Neutrino Facility hosted at Fermilab. HEP is funded at \$788 million, \$22 million above the FY 2015 enacted levels.
- **Nuclear Physics (NP)** supports research to discover, explore, and understand nuclear matter in a variety of different forms. Funding for this program includes continued construction of the Facility for Rare Isotope Beams (FRIB) at Michigan State University. NP is funded at \$625 million, \$29 million above the FY 2015 enacted levels.

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”⁸ and supports applied research, development, demonstration, and deployment (RDD&D) activities in transportation, renewable power, and energy efficiency. EERE’s primary goals include reducing U.S. reliance on fossil fuels reducing the cost of energy, reducing energy emissions, and promoting American manufacturing of clean energy technologies.⁹ The FY 2016 budget request for EERE is \$2.72 billion, an increase of \$809 million or 42.3 percent over FY 2015 enacted levels.

⁸ Department of Energy *FY 2016 Congressional Budget Request: Volume 3*, p. 9, February 2, 2015, Available at http://www.energy.gov/sites/prod/files/2015/02/f19/FY2016BudgetVolume3_7.pdf

⁹ Ibid.

EERE RDD&D is organized into three primary program areas: sustainable transportation (\$793 million, an increase of 31.7 percent), renewable power (\$645.2 million, an increase of 41.5 percent), and energy efficiency in buildings and manufacturing (\$1.03 billion, an increase of 60.4 percent). EERE programs are also major contributors for five out of six cross-cutting initiatives in the budget proposal, including Energy-Water Nexus, Grid Modernization, Subsurface Technology and Engineering, Supercritical CO₂, and Cybersecurity.

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.”¹⁰ ARPA-E was established to fund high-risk, high-impact projects that explore the development of transformational technologies that enhance economic and energy security, reduce energy imports, improve energy efficiency, and reduce emissions. The FY 2016 budget request for ARPA-E is \$325 million, an increase of \$45 million or 16.1 percent above FY 2015 enacted levels.

Fossil Energy R&D (FE)

The DOE Office of Fossil Energy (FE) supports R&D focused on coal, oil, and gas, as well as the Federal Government’s Strategic Petroleum Reserve. The FY 2016 budget request for Fossil Energy R&D (FER&D) activities is \$560 million, a decrease of \$587,000 or 0.1 percent from FY 2015 enacted levels.

Fossil Energy Research and Development (FER&D) “advances technologies related to the reliable, efficient, affordable, and environmentally sound use of fossil fuels,”¹¹ leading federal research, development, and demonstration efforts to ensure “secure, reasonably priced and environmentally sound fossil energy supplies.”¹²

FER&D includes coal R&D focusing on carbon capture and storage (CCS) and power systems (\$369 million, a decrease of 7.7 percent) and natural gas technologies R&D focused on reducing emissions and water use of shale gas development (\$44 million, an increase of 75.2 percent). The Natural Gas Technologies program also includes intergovernmental collaborative research with the Department of the Interior and Environmental Protection Agency focused on environmentally sound development of unconventional resources. FER&D programs are also major contributors to four cross-cutting initiatives in the budget proposal, including Energy-Water Nexus, Subsurface Technology and Engineering, Supercritical CO₂, and Cybersecurity.

¹⁰ ARPA-E Statutory Authority Available at <http://arpa-e.energy.gov/arpa-e-site-page/authorization>

¹¹ Department of Energy *FY 2016 Congressional Budget Request: Budget in Brief*, p. 35, February 2, 2015, Available at <http://www.energy.gov/sites/prod/files/2015/02/f19/FY2016BudgetinBrief.pdf>

¹² FE Mission Statement. Available at <http://energy.gov/fe/mission>.

Nuclear Energy (NE)

The Office of Nuclear Energy (NE) supports the diverse civilian nuclear energy programs of the U.S. Government, including federal research, development, and demonstration efforts 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.”¹³ The FY 2016 request for Nuclear Energy RD&D is \$480 million, a decrease of \$15.7 million or 3.2 percent from FY 2015 enacted levels.

Nuclear energy R&D is primarily divided into four subprograms: SMR Licensing Technical Support (\$62.5 million, an increase of 14.7 percent), Supercritical Transformational Electric Power Generation (\$5 million, equal to the FY 2015 request), Reactor Concepts Research, Development and Demonstration (\$108.1 million, a decrease of 18.7 percent), Fuel Cycle Research and Development (\$217 million, an increase of 10.5 percent), and Nuclear Energy Enabling Technologies (\$86.3 million, a decrease of 14.5 percent). NE R&D programs are also major contributors to three cross-cutting initiatives in the budget proposal, including Subsurface Technology and Engineering, Supercritical CO₂, and Cybersecurity.

Electricity Delivery and Energy Reliability (OE)

The mission of the Office of Electricity Delivery and Energy Reliability is driving “electric grid modernization and resiliency in the energy infrastructure” and leading efforts to “ensure a resilient, reliable, and flexible electricity system.”¹⁴ OE is also the federal government’s energy sector-specific lead in responding to both physical and cyber emergencies to energy infrastructure. The FY 2016 budget request for OE is \$270.1 million, an increase of \$123.1 million or 83.8 percent from FY 2015 enacted levels.

OE R&D is primarily divided between four program areas: Clean Energy Transmission and Reliability (\$40 million, an increase of 16.7 percent), Smart Grid Research and Development (\$30 million, an increase of 94.3 percent), Cybersecurity and Energy Delivery Systems (\$52 million, an increase of 13 percent), and Energy Storage (\$21 million, an increase of 75 percent). OE R&D programs are also major contributors to two cross-cutting initiatives in the budget proposal, including Grid Modernization, and Cybersecurity.

¹³ NE Mission Statement. Available at <http://energy.gov/ne/mission>.

¹⁴ OE Mission Statement. Available at <http://energy.gov/oe/mission>.

Chairman SMITH. The Committee on Science, Space, and Technology will come to order.

Without objection, the Chair is authorized to declare recesses of the Committee at any time. And we welcome you all to this hearing.

The subject of the hearing is "An Overview of the Department of Energy's Budget Proposal for Fiscal Year 2016." I will recognize myself for an opening statement and then the Ranking Member.

The Committee on Science, Space, and Technology focuses on the future. Our jurisdiction includes scientific research, development, and demonstration that makes possible America's technological innovations and industrial competitiveness.

Today, we will examine the science and energy research, development, and demonstration activities of the Department of Energy. This includes the Office of Science, which conducts critical research in high-energy physics, advanced scientific computing, biological and environmental research, nuclear physics, fusion energy sciences, and basic energy sciences, as well as applied energy research and development in fossil, nuclear, and renewable energy. These areas comprise approximately 1/3 of the DOE's budget, or over \$10 billion in the President's fiscal year 2016 proposal.

DOE is the largest federal supporter of basic research and development and sponsors 47 percent of federal basic research in the physical sciences. The Department's science and energy research is conducted at over 300 sites nationwide, including our 17 national labs. Over 31,000 scientific researchers take advantage of DOE user facilities each year.

However, the President's budget proposal appears to ignore the fiscal realities and constraints facing the nation. The DOE request proposes an overall increase of \$2.5 billion, or more than nine percent, for the Department in Fiscal Year 2016 for a total of \$30 billion. With this request, the Administration continues to prioritize short-term, expensive commercialization activities and energy subsidies that result in the government picking winners and losers in the energy technology marketplace.

The Administration claims to be a proponent of a balanced, all-of-the-above energy strategy. While I applaud the requested increased investment in basic scientific research and development, I am concerned that the President's true priorities in this budget lie elsewhere. For example, the Office of Energy Efficiency and Renewable Energy receives an increase of \$809 million, or 42 percent. In comparison, the budgets for fossil and nuclear energy research and development remain stagnant. The President's budget does not call for the most effective or efficient use of taxpayer dollars nor does it support a balanced, all-of-the-above energy strategy.

That said, I want to thank our witness, Secretary Moniz, for joining us today. While we may disagree on spending and research priorities, we do share an appreciation for the vital role DOE has in maintaining American leadership in scientific discovery and technological achievement.

The robust partnership between DOE scientists, academia, and the private sector has produced innovative breakthroughs in research as diverse as supercomputing, genomics, and nuclear science. It has helped us create the most reliable, affordable, and

secure domestic energy portfolio in the world. But we cannot afford to let Department of Energy research exist in a vacuum. We must do more to provide American entrepreneurs the opportunity to collaborate with DOE researchers and to take technology developed in the laboratory and apply it to their designs.

America's energy future is increasingly shaped by federal regulations. We must ensure that the Department of Energy provides technical expertise on the necessary energy infrastructure, the readiness of new energy technology for commercial deployment, and the impact new regulations have on the security and reliability of our electric grid. Sound science must be the guide, not politics.

Nowhere is this more apparent than with the Keystone pipeline and Yucca Mountain, where the science has consistently pointed to the safety of the projects, but politics drives endless delays, sometimes even a veto. Just yesterday, the President vetoed a bipartisan Keystone pipeline bill that an overwhelming majority of Americans rightfully support.

Finally, it is our responsibility in Congress to ensure American tax dollars are spent wisely and efficiently. While funding every research project seems like a worthy goal, it is simply unsustainable. We will have to make tough choices about how to best use our limited resources. As we shape the future of the Department of Energy, our priority must be to emphasize basic energy research and development, not to impose expensive and often inefficient technology on the American people. Instead, the Administration should invest in breakthrough discoveries from basic research that will continue to provide the foundation for private sector development across the energy spectrum. This will create jobs and grow our economy, which I think is a goal we all share.

[The prepared statement of Mr. Smith follows:]

PREPARED STATEMENT OF COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
CHAIRMAN LAMAR SMITH

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The President's budget does not call for the most effective or efficient use of taxpayer dollars nor does it support a balanced, all-of-the-above energy strategy.

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Finally, it is our responsibility in Congress to ensure American tax dollars are spent wisely and efficiently. While funding every research project seems like a worthy goal, it is simply unsustainable.

We will have to make tough choices about how to best use our limited resources. As we shape the future of the Department of Energy, our priority must be to emphasize basic energy research and development, not to impose expensive and often inefficient technology on the American people.

Instead, the administration should invest in breakthrough discoveries from basic research that will continue to provide the foundation for private sector development across the energy spectrum. This will create jobs and grow our economy, which is a goal I think we all share.

Chairman SMITH. That concludes my opening statement. And the gentlewoman from Texas, Eddie Bernice Johnson, is now recognized for hers.

Ms. JOHNSON. Thank you very much, Mr. Chairman, and thank you for holding this hearing. I would like to thank Secretary Moniz for being here today to discuss the proposed DOE budget and for his continued service to our nation.

Let me start by reminding my colleagues that we have seen how government-supported research can pay off. When it comes to energy development, DOE-supported research was key to development of high-efficiency gas turbines for coal plants, nuclear reactors, and the directional drilling and hydraulic fracturing technologies and techniques that have led to the shale gas boom of today. But we should remember that those achievements required decades of federal investment, the overwhelming majority of which were focused on fossil energy and the first generations of nuclear power reactors.

I continue to support research to make today's technologies safer, cleaner, and more efficient, but we also have to find the greatest value for our investment of taxpayers' dollars. The reality today is that the emerging energy technology sectors can most benefit from government support. That is where the priorities set by DOE's fiscal year 2016 budget request come into play.

I am pleased with much of the Department's budget request for science and energy research this year. If adopted, the DOE Office of Science, the Office of Energy Efficiency and Renewable Energy, ARPA-E, the Office of Electricity, and Nuclear Energy would all receive much-needed boosts, to advance the development of fundamental science and clean energy technologies that will be vital to our national security, our economy, and the environment in decades to come. For example, the Geothermal and Marine Energy Research programs would establish important new test sites to help advance next-generation renewable energy technologies, and the Department's important Advanced Manufacturing Program that would expand considerably.

I am also pleased to see that under the Secretary's leadership, the Department is clearly making progress in coordinating several critical research areas that cut across its various programs, including the Water-Energy Nexus, which I personally am very concerned about, advanced computing and modernization of our woefully outdated electric grid.

However, I do have concerns with a few areas of the Department's proposed budget. The Advanced Reactor Program within the Office of Nuclear Energy and the Fusion Energy Program within the Office of Science would both receive sizable cuts, some of it in Mr. Smith's district, as an aside, under the proposed DOE budget. Over the long-term, both of these types of advanced technologies have potential to play a major role in enabling a vibrant low-carbon economy. So I hope we can discuss this further and see if perhaps these funding levels should be reconsidered.

In addition, while I certainly appreciate seeing the Department place a stronger emphasis on addressing the environmental impacts of developing our coal and natural gas resources, I would like

to learn more about how the significant shifts you proposed to the fossil energy research budget will affect these efforts.

All that said, I believe that the Department has proposed a serious request worthy of our careful consideration and I look forward to working with you, Mr. Secretary, and my colleagues across the aisle, to address any remaining concerns we have and to ensure that you have the direction, tools, and the resources you need to help secure our nation's energy future. Thank you, and I yield back the balance of my time.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
RANKING MEMBER EDDIE BERNICE JOHNSON

Thank you, Chairman Smith for holding this hearing. I would also like to thank Secretary Moniz for being here today to discuss the proposed DOE budget and for his continued service to our nation.

Let me start by reminding my colleagues that we have seen how government-supported research can pay off when it comes to energy development. DOE-supported research was key to the development of high-efficiency gas turbines for coal plants, nuclear reactors, and the directional drilling and hydraulic fracturing technologies and techniques that have led to the shale gas boom of today. But we should remember that those achievements required decades of federal investment, the overwhelming majority of which was focused on fossil energy and the first generations of nuclear power reactors. I continue to support research to make today's technologies safer, cleaner, and more efficient, but we also have to find the greatest value for our investment of taxpayer dollars. The reality today is that the emerging energy technology sectors that can most benefit from government support. That is where the priorities set by DOE's Fiscal Year 2016 budget request come into play.

I am pleased with much of the Department's budget request for science and energy research this year. If adopted, the DOE Office of Science, the Office of Energy Efficiency and Renewable Energy, ARPA-E, the Office of Electricity, and Nuclear Energy would all receive much-needed boosts to advance the development of fundamental science and clean energy technologies that will be vital to our national security, our economy, and the environment in the decades to come. For example, the geothermal and marine energy research programs would establish important new test sites to help advance next generation renewable energy technologies, and the Department's important advanced manufacturing program would expand considerably. I am also pleased to see that, under the Secretary's leadership, the Department is clearly making progress in coordinating several critical research areas that cut across its various programs, including the energy-water nexus—which I personally am very concerned about, advanced computing, and modernization of our woefully outdated electric grid.

However, I do have concerns with a few areas of the Department's proposed budget. The advanced reactor program within the Office of Nuclear Energy and the fusion energy program within the Office of Science would both receive sizable cuts under the proposed DOE budget. Over the long term, both of these types of advanced technologies have the potential to play a major role in enabling a vibrant low-carbon economy, so I hope we can discuss this further and see if, perhaps, these funding levels should be reconsidered. In addition, while I certainly appreciate seeing the Department place a stronger emphasis on addressing the environmental impacts of developing our coal and natural gas resources, I would like to learn more about how the significant shifts you've proposed within the Fossil Energy research budget will affect these efforts.

All that said, I believe that what the Department has proposed a serious request and worthy of our careful consideration. I look forward to working with you, Mr. Secretary, and my colleagues across the aisle, to address any remaining concerns we have and to ensure that you have the direction, tools, and resources you need to help secure our nation's energy future.

With that I yield back the balance of my time.

Chairman SMITH. Thank you, Ms. Johnson.

Our witness today is Hon. Ernest Moniz, Secretary of the Department of Energy. Prior to his appointment, Dr. Moniz was the head of the Department of Physics at the Massachusetts Institute of Technology where he was a faculty member since 1973.

Previously, Dr. Moniz served as Under Secretary of the Department of Energy where he oversaw the Department's Science and Energy Programs. From 1995 to 1997 he served as the Associate Director for Science in the Office of Science and Technology Policy in the Executive Office of the President.

Dr. Moniz brings both impressive academic credentials and practical skills to a very demanding job. Dr. Moniz received a bachelor of science degree in physics from Boston College and a doctorate in theoretical physics from Stanford University.

Before I conclude, I would like to recognize—they aren't here today but I am going to recognize them in their absence—Alamo Heights High School in my home district of San Antonio Texas who recently won their regional competition for the 2015 National Science Bowl. DOE's Office of Science's National Science Bowl is one of the most distinguished science academic competitions in the United States for students, and I congratulate the students at Alamo Heights High School and I wish them the best as they prepare to travel to Washington, D.C., for the national finals at the end of April. These competitions inspire students to work hard and help shape America's future innovators.

And, Mr. Secretary, I hope you don't mind my adding that to your introduction this morning. And with that, we will recognize Secretary Moniz for five minutes or longer, however much time he would like to present his testimony. And we welcome you today.

**TESTIMONY OF ERNEST MONIZ, SECRETARY,
U.S. DEPARTMENT OF ENERGY**

Secretary MONIZ. Well, thank you, Chairman Smith and Ranking Member Johnson and all Members of the Committee. I certainly, by the way, never mind an advertisement for the National Science Bowl and look forward to working with the Committee.

If I may, I would also like to introduce behind me Under Secretary for Science and Energy, Franklin Orr, who is here, just to say that he was confirmed in December in the lame duck and he is someone I urge you to get to know as the new Under Secretary looking at the integration of our energy and science programs.

So, again, I am pleased to be here and to discuss our fiscal year 2016 \$29.9 billion request, as the Chairman mentioned, a roughly nine percent increase from the current level.

As you know, again, we have a diverse portfolio from all-of-the-above energy strategy to the backbone for basic research in the physical sciences, ensuring nuclear security, and cleaning up the Cold War environmental mess. Clearly, the science and energy programs are those of principal interest today. As to the energy mission, again, I do want to emphasize that we are committed to the all-of-the-above approach, and I am sure we will discuss that in more detail.

If I look at the science arena fiscal year 2016, \$5.34 billion request, or a five percent increase, we are continuing to build this na-

tion's research infrastructure, the cutting-edge of light sources, supercomputers, neutron sources, other facilities the Chairman already mentioned serving 31,000 scientists across the country. I will just note that only a few weeks ago I was able to cut the ribbon at Brookhaven, now the world's brightest light source came in on budget and under schedule by 6 months. We have commissioned major facilities coming on this year, a 12 GeV upgrade at the Jefferson lab in Virginia, a fusion experiment at Princeton, and now with this budget we will be building the next x-ray laser at SLAC and a rare isotope beam facility at Michigan state, for example. I want to emphasize that no matter what the budget is, we have to keep moving to the front tier with these facilities to serve our national research community.

And in the energy arena, \$5.38 billion, or 8.27 percent increase, and we have seen a number of accomplishments. This year we will hit 10 million tons of CO₂ sequestration, for example. Last year, through our assistance, first two commercial-scale cellulosic biofuels facilities came online in Iowa and in Kansas. We moved forward on efficiency standards last year that cumulatively to 2030 will reduce carbon dioxide emissions by over 435 million tons and save consumers an estimated \$78 billion in energy costs.

Advance manufacturing, as the Ranking Member mentioned, is a key priority moving forward with manufacturing institutes. We all know that manufacturing has been a great story for our country in the last years. Energy developments have been a big part of that so I believe, as has been our focus on this, and I can come back and describe some extraordinarily interesting development there. The budget includes things like going to SuperTruck, doubling heavy vehicle Class A truck efficiencies, for example, and a strong focus on continuing the dramatic progress in electric vehicles.

We will continue our program with carbon capture utilization and sequestration but I want to emphasize here that, in addition to the technology push and demonstrations, that this will go hand-in-hand with the tax credits proposed this year by the Administration, including \$2 billion credit subsidy for carbon capture and sequestration infrastructure and an additional tax credit for carbon that is sequestered.

ARPA-E, we request an increase from 280 to \$325 million. We are approaching now the 5th anniversary—next month will be the 5th anniversary of the first signed contract and we have always said, you know, that is kind of time frame that we need to see the outcomes of these programs and we are seeing those outcomes. We are seeing 30 companies formed, we are seeing another 37 that have attracted support from other federal agencies, we are seeing these products actually getting into the marketplace. So this is a great success. And just this week, the American Energy Innovation Council composed of major CEOs in our country repeated their call of several years ago that ARPA-E deserves a billion a year, so I think in that context you can agree we have a very modest request with our \$45 million increase proposed.

Crosscutting Electricity Grid Initiative, \$356 million. I want to emphasize that we will soon, and I hope within weeks, be able to come out and talk with you about our Quadrennial Energy Review focusing on energy infrastructure revitalization needs. This grid

initiative frankly is part of that thrust, as are other proposals that will be coming out in the QER and are reflected already in our fiscal year 2016 budget such as two new state grant programs we propose for a total of \$63 million going to the States for reliability planning and energy assurance planning.

I will just say a word because it is not the main focus, but to complete the picture, in nuclear security we propose \$11.6 billion for NNSA, a ten percent increase. I will just say that this will, we are confident, allow us to continue our safe and reliable stockpile without testing. It will allow us to continue to secure materials that we need to have secured globally as we did last year, and it will continue our nuclear Navy towards being able to deploy the next generation aircraft carrier and the next generation strategic submarine fleet beyond the Ohio class.

And finally, management and performance, the biggest budget item there was our Environmental Management Program. We have proposed \$5.8 billion. It is essentially constant with the appropriation although an increase from our traditional request there, and that is very important for advancing our very high-priority projects.

And I will just end by saying in the management arena, in addition to the Environmental Management Program, we have also, for example, revamped our whole approach to project management taking an enterprise-wide approach. I would be happy to describe that in more detail. I believe that this will continue our progress in getting control over major projects. I do note that we are off the high-risk list for all of the science projects and for all of the other projects up to \$750 million. Now, we are going to get the last five or six off that list and I believe we are making progress. And again, that is something I would be happy to discuss now or later with the Committee.

With that, Mr. Chairman, that ends my opening remarks.
[The prepared statement of Secretary Moniz follows:]

Testimony of Secretary Ernest Moniz
U.S. Department of Energy
Before the
U.S. House Committee on Science, Space, and Technology
February 25, 2015

Chairman Smith, Ranking Member Johnson, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the Department of Energy's (DOE) Budget Request for fiscal year (FY) 2016. I appreciate the opportunity to discuss how the Budget Request advances the Department of Energy's missions.

Advancing Nuclear Security, Science & Energy, and Environmental Cleanup

DOE is entrusted with a broad and diverse portfolio across its three major mission areas of nuclear security, science and energy, and environmental management. The Budget Request for fiscal year (FY) 2016 for the Department of Energy is \$29.9 billion, \$2.5 billion above FY 2015 enacted, to support our mission responsibilities and to continue improving our management and performance in support of those missions.

For nuclear security, the Budget includes \$12.6 billion, an increase of \$1.2 billion over the FY 2015 enacted level, to support DOE's responsibilities of maintaining and modernizing, via life extension programs, the nuclear deterrent without testing; controlling and eliminating nuclear materials worldwide and providing nuclear and radiological emergency response capabilities in an age of global terrorism; and propelling our nuclear Navy.

For science and energy, the Budget includes \$10.7 billion, an increase of \$1.3 billion over the FY 2015 enacted, to support DOE's missions of enabling the transition to a clean energy future with low-cost, all-of-the-above energy technologies; supporting a secure, modern, and resilient energy infrastructure; and providing the backbone for discovery and innovation, especially in the physical sciences, for America's research community.

For environmental management, the Budget includes \$5.8 billion, to support DOE's responsibility of cleaning up from the Cold War legacy of nuclear weapons production.

Approximately \$18.9 billion, or 63 percent of the Department's Budget Request, is national security-related funding, including the nuclear security and most of the environmental management programs. The remaining 37 percent is for non-defense programs in energy, science, and other programs such as building capabilities to respond to energy disruptions, enhancing data collection and analysis in critical areas, and supporting obligations for international cooperation in clean energy and energy security.

Science: Leading Edge Research and World Class Research Infrastructure

Starting with basic research, DOE's Office of Science is the largest federal sponsor of basic research in the physical sciences, supporting 22,000 researchers at 17 National Laboratories and more than 300 universities. Informed by the latest science advisory council reports and recommendations, the FY 2016 Budget Request provides \$5.34 billion for Science, \$272 million above the FY 2015 enacted level, to continue to lead basic research in the physical sciences and develop and operate cutting-edge scientific user facilities while strengthening the connection between advances in fundamental science and technology innovation.

One of the signature aspects of our basic science research program is the Department's support for the construction and operation of major user facilities at the national laboratories that serve over 31,000 scientists and engineers each year on an open-access basis. We are committed to staying at the cutting edge of light sources, super computers, neutron sources, and other facilities essential to advancing our mission. In the last year, for example, we completed the brightest light source in the world, the National Synchrotron Light Source II at Brookhaven National Laboratory, ahead of schedule and on budget. We are at the commissioning phase of the 12 GeV Upgrade to the Continuous Electron Beam Accelerator Facility at the Thomas Jefferson National Accelerator Facility, and the National Spherical Torus Experiment at Princeton Plasma Physics Laboratory intends to begin research this summer after a significant upgrade.

Looking forward in the FY 2016 Budget, we continue construction of critical, new user facilities while ensuring increased investment in national laboratory infrastructure renewal to help sustain America's scientific enterprise. The Request supports a major upgrade of the Linac Coherent Light Source at SLAC and construction of the Facility for Rare Isotope Beams at Michigan State University. In addition, the Budget provides approximately \$2 billion to fund operations of our 27 existing scientific user facilities.

These facilities investments and research grants funded by the Office of Science will ensure that we continue to support discovery science, as well as science that underpins future energy and other technologies.

For example, using the current Linac Coherent Light Source at SLAC, scientists last year mapped for the first time the structure of a protein within a living cell. This single example highlights the tremendous benefits of our national laboratories in a broad range of scientific and applied areas. In addition, the Office of Science supports research at hundreds of universities in all fifty states through competitive grants to advance our mission. For example, a university group recently developed a new class of polymer-based flexible electronics for solar cells and medical applications through DOE-funded research.

High performance computing is a traditional area of strength and responsibility for the Department of Energy that has been an important component of U.S. leadership in science and technology more broadly. The FY 2016 Budget grows our investment significantly to \$273 million for a multi-year, joint Office of Science-National Nuclear Security Administration (NNSA) effort to achieve exascale computing—computing platforms with 100 to 1000 times more computational power than today's systems. This effort requires researchers and industry to overcome a number of technical challenges, including energy and big data management, as part of our push to develop enabling capabilities for exascale computing. We recently announced the joint Collaboration of Oak Ridge, Argonne, and Lawrence Livermore (CORAL) to advance within an order of magnitude of the exascale target within a few years. In addition, the Office of Science is supporting the Computational Science Graduate Fellowship program to support training in advanced scientific computing. These investments will ensure continued U.S. leadership of this critical capability in a very competitive global environment.

The Budget provides funding at the FY 2015 level for the U.S. contributions to the ITER project, a major international fusion facility currently under construction in France. ITER will be the world's first magnetic confinement long-pulse, high-power burning plasma experiment aimed at demonstrating the scientific and technical feasibility of fusion energy, and the request includes support for important critical-path items.

We will continue in this Budget to grow the Energy Frontier Research Center (EFRC) program by initiating five new centers and continuing support for existing Centers, for a total investment of \$110 million in FY 2016. This EFRC program is our flagship investment in basic science that underpins future energy technologies.

With our Budget Request, we support Fermilab operations at a total of \$135 million for operations, which includes operations of the NOvA neutrino experiment. We are also investing \$20 million to move forward planning and design for the Long Baseline Neutrino Facility at Fermilab. Last year, the particle physics community came forward with a visionary strategic plan for the High Energy Physics program, and our Budget Request responds to their recommendations, specifically by aiming to develop a strong international consortium for the next generation of neutrino physics experiments.

Energy

All-of-the-Above Energy Approach for a Clean Energy Economy

Preparing for the clean energy economy in order to address climate change and energy security, principally through science and technology, is an essential focus of the Department of Energy. The President's Climate Action Plan is a guiding document for our efforts to mitigate climate change risks through clean energy technologies. The Administration remains committed to an all-of-the-above energy approach, and we believe that we need to enable technologies across all fuel sources to become competitors in a future clean energy marketplace.

In the last year, we have seen important accomplishments across the Department's technology portfolio that highlight our all-of-the-above approach. We have geologically sequestered over 9 million metric tons of CO₂ through DOE-supported projects. Two commercial-scale cellulosic ethanol facilities supported by

DOE grants or loan guarantees have commenced operations. We have commissioned one of the world's largest battery storage systems at the Tehachapi Wind Energy Storage Project. We have issued ten final appliance energy efficiency standards in calendar year 2014, which altogether will help reduce carbon dioxide emissions by over 435 million metric tons through 2030. Standards enacted since 2009 are projected to avoid a cumulative total of 2.2 billion metric tons of carbon emissions through 2030. The Office of Energy Efficiency and Renewable Energy (EERE) has achieved 70 percent of the SunShot goal of cost parity for utility scale solar energy.

The Advanced Research Projects Agency—Energy's (ARPA-E) grant program has attracted more than \$850 million in private follow-on funding to 34 ARPA-E projects, with 30 ARPA-E teams forming new companies.

EERE has launched the Frontier Observatory for Research in Geothermal Energy (FORGE), a first-of-a-kind field laboratory to deploy enhanced geothermal energy systems, and we have seen battery technology improvements that are projected to reduce battery costs for electric vehicles by 40 percent. The Office of Nuclear Energy has successfully completed the first 5-year program at the Consortium for Advanced Simulation of Light Water Reactors (CASL) nuclear modeling Hub at Oak Ridge and has initiated a second award for design and licensing support of a small modular nuclear reactor with advanced safety features.

Consistent with an all-of-the-above energy strategy, the DOE Loan Programs Office has issued loan guarantee solicitations for innovative technologies in four areas, including \$4 billion for renewable energy and energy efficiency, \$8 billion for fossil energy, \$12 billion for nuclear energy, and \$16 billion for advanced vehicle technology manufacturing.

Projects that this program has supported include one of the world's largest wind farms; several of the world's largest solar generation and thermal energy storage systems; Tesla Motors; and more than a dozen new or retooled auto manufacturing plants. This program's accomplishments include issuing loan guarantees for projects that avoided more than 6.1 million metric tons of carbon dioxide cumulatively in 2014, and for companies that produced more than 2.1 million fuel-efficient vehicles in 2014. We are moving aggressively in finding good projects to

deploy innovative energy technologies using the remaining \$40 billion in loan authority in the coming years.

Together, these accomplishments illustrate how DOE's programs invest in an all-of-the-above spectrum of energy technologies, and the FY 2016 Budget Request continues forward on that strategy with a \$5.4 billion request for our applied energy programs.

Advanced manufacturing will continue to be a major focus of our investments. We will continue to help support an American manufacturing renaissance. The FY 2016 Budget fully funds two new clean energy manufacturing innovation institutes and continues funding for four institutes, as part of the larger National Network for Manufacturing Innovation, including the advanced composites manufacturing institute in Tennessee the President announced in January. To support these institutes, the Request provides \$196 million out of a total request of \$404 million for EERE's Advanced Manufacturing program.

In energy efficiency, the Request invests \$264 million, an increase of \$92 million, to develop and promote the adoption of technologies and practices that, when fully deployed, would reduce U.S. building-related energy use by 50 percent from the 2010 Annual Energy Outlook baseline. It also provides \$228 million, \$35 million above FY 2015, to support competitively selected projects, training and technical assistance, and residential energy efficiency retrofits to approximately 33,000 low-income households nationwide.

The FEMP Budget includes \$15 million for the Federal Energy Efficiency Fund which provides direct assistance to agencies for investing in priority energy projects for efficiency and renewables. By providing direct funding and leveraging cost sharing at other agencies, the fund creates greater opportunities to develop Federal projects that may not otherwise be implemented.

The Request increases our investments in sustainable transportation, including \$40 million for the SuperTruck II initiative to develop and demonstrate technologies to double class 8 freight truck efficiency by 2020 from a 2009 baseline. The Request also continues our focus on electric vehicles by investing \$253 million in the EV Everywhere initiative, which aims to enable domestic production of plug-in

vehicles that are as affordable and convenient as gasoline vehicles by 2022. By continuing to make progress in core component technologies such as the dramatic reductions we are seeing in battery and fuel cell costs, we are looking to achieve transformative performance improvements for electric vehicles in the marketplace.

In biofuels, the Budget continues our focus on drop-in fuels, which can take advantage of existing infrastructure, and we will provide \$45 million for the jointly funded USDA/DOD/DOE commercial scale biorefineries program to produce military specification drop-in fuels. We will also continue research and development efforts on supplying, formatting, and converting cellulosic and algae-based feedstocks to bio-based gasoline and diesel, with a \$138 million investment in the FY 2016 Request.

The Budget continues to support accelerated advances in renewable energy. The SunShot Initiative has helped accelerate the reduction in solar costs, and our request of \$337 million, an increase of \$104 million, aims to continue progress to achieve cost parity without subsidies by 2020. For wind energy, the Request of \$146 million, an increase of \$39 million, includes funding for year five of a six fiscal-year Offshore Wind Advanced Technology Demonstration program supporting three offshore wind projects on track to begin operation in 2017. Our request of \$96 million for geothermal energy, \$41 million above FY 2015, implements the FORGE, an experimental facility aimed to advance enhanced geothermal systems, and pursues new approaches to hydrothermal development with a special focus on collaborative efforts with the Office of Fossil Energy on subsurface science, technology and engineering.

As we witness the transformation of our Nation's electric grid, the Department continues to drive electric grid modernization and resilience. In May 2014, with cost-share funding provided by the Office of Electricity Delivery and Energy Reliability (OE), Southern California Edison constructed and installed equipment for a prototype 8 megawatt/32 megawatt-hour battery storage plant for wind integration at Tehachapi, CA. The Tehachapi Wind Energy Storage Project is positioned to demonstrate the effectiveness of lithium-ion battery and smart inverter technologies to improve grid performance and assist in the integration of variable energy resources. In addition, we continue improving the security of the Nation's energy infrastructure. Oak Ridge National Laboratory announced in

January 2015 the licensing of its Hyperion software, which helps detect software that has been maliciously altered. Today, more than 20 new technologies that OE investments helped support are now being used to further advance the resilience of the nation's energy delivery systems.

In fossil energy, we will continue our across-the-board focus on carbon capture and sequestration and improving the environmental performance of natural gas development. In particular, the FY 2016 Budget includes funding to conduct initial R&D towards demonstration of carbon capture and storage for natural gas plants. While natural gas is an important bridge fuel, natural gas, as well as coal, will need carbon capture and sequestration to compete in a future clean energy economy.

And while the FY 2016 Budget does not request new authority in these areas, the Department has \$8 billion in loan guarantee authority for advanced fossil technologies, as I mentioned earlier, and the Department will continue to work with prospective applicants. Through the President's Budget Request for the Treasury Department, the Administration is also proposing a new, \$2 billion refundable investment tax credit, including support for the infrastructure for carbon capture and sequestration, as well as a sequestration credit for commercial carbon capture use and storage (CCUS) deployment to allow for enhanced oil recovery or injection into deep saline aquifers.

In the area of nuclear energy, the Request includes \$62.5 million to continue technical support for moving a small modular reactor to the Nuclear Regulatory Commission licensing stage by the end of 2016, as a step towards industry's demonstration of this important technology early in the next decade. The Request includes \$326 million to support research and development on reactor aging issues, advanced reactor concepts, and the fuel cycle. This request continues to support R&D on nuclear fuel issues at the Idaho National Laboratory. It also supports research on accident tolerant fuels and includes funding to continue laying the groundwork for implementing the Administration's Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste, including a consent-based approach to the siting of storage and disposal facilities for nuclear waste. The Request also focuses resources on maintaining operational readiness at the Idaho National Laboratory, including \$23.2 million for major power

distribution infrastructure refurbishments and \$11.7 million for critical security infrastructure investments.

The Request includes \$325 million for ARPA-E, an increase of \$45 million from FY 2015, to continue to grow this important program. The program, which received its first appropriation in 2009, is now showing impressive results. It has over 400 projects to date, and the first group of completed projects has led to 30 new companies, of which five have been acquired by large strategic investors. Altogether, 34 ARPA-E projects have attracted over \$850 million in follow-on funding.

Through ARPA-E, we will continue to invest in early-stage innovation with the potential to lead to transformational energy technologies.

For the loan programs, while the Request does not propose new authority for the Title 17 or Advanced Technology Vehicles Manufacturing loan programs, the FY 2016 Budget does include \$9 million for credit subsidy to support a new loan guarantee solicitation for new clean energy projects on Tribal Lands.

In addition to the new loan program, the Request provides \$20 million for the Office of Indian Energy Policy and Programs, an increase of \$4 million, for its technical and financial assistance programs, with increased emphasis on remote communities and the National Strategy for the Arctic Region.

The Department's final FY 2015 Budget supported a new workforce development effort for graduate and post-doctoral training in three areas of specific mission need for the Department: high performance computing in the Office of Science, advanced manufacturing in the Office of Energy Efficiency and Renewable Energy, and subsurface topics and project management in the Office of Environmental Management. These DOE traineeships are modeled in part after other federal programs for university-led graduate traineeships and include components that are uniquely focused on DOE mission workforce training needs. Our FY 2016 Budget Request proposes to add a fourth traineeship on radiochemistry, supported by the Office of Nuclear Energy, where we see a specific mission need.

Transforming Energy Systems, Investing in Resilient Energy Infrastructure

In addition to the clean energy investments I just discussed, our Nation's energy infrastructure is an area that needs—and is now getting—more attention.

We have had several recent accomplishments relating to our energy infrastructure. Following the aftermath of Superstorm Sandy, the Office of Electricity Delivery and Energy Reliability committed \$500,000, along with EERE, totaling \$1 million for Sandia National Laboratories to provide technical assistance to New Jersey Transit and the Board of Public Utilities to assess NJ Transit's energy needs and help develop a conceptual design of an advanced microgrid system that will avoid disruptions and make it easier to get the power back on after a major disaster.

Led by our Office of Energy Policy and Systems Analysis, we have also completed a nationwide public stakeholder process and analytical work in support of the upcoming release of the first-ever Quadrennial Energy Review (QER) of U.S. energy infrastructures.

The QER is a four-year interagency process, with the first year focusing on energy infrastructure—the transmission, storage, and delivery of energy. We expect the first QER installment to be released soon, and many of you may be interested in that document for its systematic analysis of the breadth of challenges with our current energy infrastructure. The QER will also include recommendations to drive future program directions.

The electricity grid underpins many other infrastructures, and the FY 2016 Budget Request includes \$356 million, an increase of \$160 million, for a major crosscutting initiative led by the Office of Electricity Delivery and Energy Reliability to focus on the modernization of the electricity grid. This initiative invests in technology development, enhanced security, and modeling to enable the electricity grid of the future. This initiative includes \$10 million for R&D to improve resilience of large-scale electricity transformers and \$14.5 million to transition to an integrated system at the distribution level and develop a platform for market-based control signals. In addition, the Request establishes a virtual collaborative environment for conducting real-time advanced digital forensics

cybersecurity analysis, which can be used to analyze untested and untrusted code, programs, and websites without allowing the software to harm the host device.

The Request includes \$15 million to develop advanced technologies to detect and mitigate methane emissions from natural gas transmission, distribution, and storage facilities, and \$10 million to improve methane leakage measurements.

We will focus new attention on state grants for energy assurance and reliability, recognizing that many authorities and actions in this area depend upon the states. The FY 2016 Request includes \$35.5 million to provide grants to state, tribal, and local governments to update energy assurance plans to address infrastructure resilience, as well as \$27.5 million that is part of the Grid Modernization crosscutting initiative to provide competitive grants to states and multi-state entities to address electricity reliability.

Finally, while we move toward implementation of recommendations on the first installment of the QER on infrastructure, DOE will move forward on future installments of the 4-year QER. The Budget includes \$35 million for the Office of Energy Policy and Systems Analysis to provide integrated energy systems analysis and follow-on QER support activities.

In addition to the longstanding major mission areas of nuclear security, science and energy, and environmental cleanup, emergency response is an important mission for the Department. While we have had an ongoing responsibility for nuclear and radiological incident response, the Department has intensified its efforts for energy infrastructure emergency response, working with FEMA. Our Budget proposes an increase from \$6 million to \$14 million for Infrastructure Security and Energy Restoration, the lead program for these responses. While the budget for this emerging responsibility is relatively small, it is an increasingly important focus.

Enhancing Collective Energy Security

The Department's work in energy security is modest in budget requirements but greatly important for the Nation. Particularly given the events in Europe and Ukraine, we have an increased global focus on collective energy security—energy security for the United States and its allies.

In the last year, we worked with the G-7 and the European Commission to achieve a G-7 Leaders Agreement on a new collective energy security framework. Led by our Office of International Affairs, we also worked directly with Ukraine to provide technical support in developing its first ever energy emergency management plan, especially for the winter. In December, we also signed a Memorandum of Understanding with Canada and Mexico to initiate improved coordination of North American energy data. Led by DOE's Energy Information Administration (EIA), this will help us develop stronger active collaboration moving forward.

To continue on this progress for collective energy security, the FY 2016 Budget Request includes \$24 million for the Office of International Affairs. While the funding level is not large compared with other parts of the Department, the Office of International Affairs is taking on increased responsibility, as I just highlighted, and funding at this level is needed to fulfill its important mission and strengthen international energy technology, information and analytical collaborations.

Similarly, the Budget increases investment in the EIA to \$131 million, in order to fill gaps in current energy data, including transportation of oil by rail and integrating energy data with Canada and Mexico. The EIA recently initiated a data reporting program on oil and natural gas production trends by region, and the requested increase is needed to continue with this and other improvements in our data collection, analysis, and reporting.

Last year, the Department also completed a 5 million barrel test sale for the Strategic Petroleum Reserve (SPR) to look at infrastructure challenges resulting in large part from pipelines now flowing in opposite directions from when the SPR was originally established. Through the test sale, we found challenges confronting the SPR's distribution system, and the FY 2016 Budget proposes an increase of \$57 million above FY 2015 for the SPR to begin addressing the operational readiness issues found through the test sale to enhance distribution flexibility and reliability and to begin to address the existing backlog of deferred maintenance projects.

Strategic Partnerships with National Laboratories to Advance DOE Missions

The Department is continuing its focus on building the strategic partnership with the National Laboratories. DOE is a science and technology agency, and our efforts across all of our mission areas are heavily grounded in science and technology. The National Labs are a major core asset in executing our missions, and strengthening our partnerships is critical to our success.

We are doing that in a variety of ways. For example, DOE is engaging the laboratories very early on in our program planning. The National Laboratories Ideas Summit helped shape FY 2016 budget initiatives and was instrumental in forming a special consortium of 14 National Laboratories arranged to implement the crosscutting grid modernization research.

We also have begun using the National Laboratories' expertise in science and technologies in some of our major challenges outside of the science and energy arena. When faced with what looked like major problems with the cost and schedule of the Uranium Processing Facility (UPF) at the Y-12 National Security Complex in Oak Ridge, or the major problem we had at the Waste Isolation Pilot Plant (WIPP), we engaged Laboratory leadership to help reformulate our approach to those issues. In those two examples, Oak Ridge National Laboratory led the Red Team review and restructuring of UPF, and the Savannah River National Laboratory led the forensics effort to investigate the cause of the failure of the waste canister at WIPP.

The Laboratory Operations Board (LOB), a body that we put in place in 2013, performed the first-ever uniform assessment of general purpose infrastructure at all Laboratories and NNSA plants. That has led to identifying over \$100 million in the FY 2016 Budget in new investments for priority general purpose infrastructure projects guided by LOB assessments, while also avoiding an increase in deferred maintenance.

Finally, we have developed new strategies to strengthen institutional capability of the National Laboratory system based on advice from the Secretary of Energy Advisory Board (SEAB)

Enhancing Impact: Crosscutting Initiatives in Key Technology Areas

The FY 2016 Budget expands the crosscutting initiatives introduced in the FY 2015 Budget designed to advance key technology areas that have multiple energy resource applications. Each crosscut reflects an integrated plan of work to optimize programmatic objectives by efficiently allocating resources. Through deliberate and enterprise-wide planning and coordination of these research efforts, the crosscutting initiatives will help bolster DOE's efforts to institutionalize enhanced program management and coordination across program offices, while accelerating progress on key national priorities.

The programs and budgets within the three mission areas include over \$1.2 billion in crosscutting R&D across six initiatives focusing on: electricity grid modernization, subsurface technology and engineering, supercritical carbon dioxide technology, energy-water nexus, exascale computing, and cybersecurity. These initiatives are the product of a concerted coordination effort among all three DOE Under Secretariats and program offices across the Department in close collaboration with the National Laboratories.

The FY 2016 Budget continues to build on the five crosscutting initiatives established in FY 2015. The Exascale Computing initiative invests to make progress toward a thousand-fold improvement over current high performance computers. Grid Modernization supports technology development, enhanced security, and stakeholder support to enable evolution to the grid of the future. The Subsurface Engineering initiative invests in new wellbore systems, seismic research, and other areas supporting a wide variety of energy sources. The Supercritical Carbon Dioxide initiative establishes a 10 MWe-scale pilot Supercritical Transformational Electric Power facility aiming to increase the efficiency of power generation, and the Cybersecurity crosscutting initiative strengthens cybersecurity across DOE's federal and laboratory sites, and improves cybersecurity for the nation's electric, oil, and gas sectors.

The FY 2016 Budget also proposes one new crosscutting initiative, the Energy-Water Nexus. This initiative recognizes that the Nation's energy system uses large quantities of water, and the Nation's water system uses large quantities of energy,

and that DOE's coordinated science and technology efforts can contribute to the Nation's transition to more resilient energy-water systems.

Nuclear Security

The FY 2016 Budget Request provides \$12.6 billion for the NNSA, an increase of \$1.2 billion over FY 2015, to carry out our missions for the nuclear deterrent, nuclear nonproliferation programs, and propulsion for the nuclear Navy.

Effective Stewardship of the Nuclear Deterrent

The Request includes \$8.8 billion for Weapons Activities, \$667 million above FY 2015, to maintain a safe and effective nuclear deterrent while continuing to reduce the size of the active stockpile.

In pursuit of this mission, we have recently achieved a number of major accomplishments. We have, first and foremost, had another year of science-based certification of the stockpile as safe, secure, and effective without nuclear testing. It is important to remember the remarkable story that a science research program has enabled the paradigm to shift since nuclear testing ceased to allow us to consistently certify the stockpile as safe and reliable without testing, even as it shrinks.

In the major life extension programs, we have now passed the halfway mark in Life Extension Program (LEP) for the W76-1 warheads for the Navy, and our FY 2016 Budget Request of \$244 million will keep us on track to complete the program in 2019. We have conducted successful first integration testing of the B61-12 LEP for the Air Force on or ahead of schedule, and the Request of \$643 million supports delivery of the First Production Unit in 2020. By the end of FY 2024, completion of the B61-12 LEP will shrink the number of active and inactive weapons, reduce the mass of nuclear material used in these weapons, and allow us to retire the B83, the last U.S. megaton class weapon. Our Request of \$220 million for the W88 ALT 370 supports delivery of the First Production Unit with conventional high explosives refresh by FY 2020.

This Budget supports the Nuclear Weapons Council decision to accelerate a new cruise missile capability, and the selection of the W80 as the warhead for the Air

Force's Long Range Stand-Off system (LRSO). The FY 2016 Budget Request includes \$195 million to accelerate the program by two years, to be completed in 2025, in order to meet military requirements.

We have begun operations in the new Kansas City Responsive Infrastructure Manufacturing and Sourcing (KCRIMS) facility with half the footprint and an improved operating environment compared to the old environment. And at the National Ignition Facility, we have significantly increased the shot rate and achieved impressive advances in experimental results in closer alignment with modeling predictions.

As I mentioned earlier, we have used strategic partnerships with the National Laboratories to rethink some of our challenging projects. As a result of the Red Team review of the Uranium Processing Facility at the Y-12 National Security Complex in Oak Ridge, led by the Director of the Oak Ridge National Laboratory, and a similar review of the Chemistry and Metallurgical Research Replacement Facility (CMRR) capability at Los Alamos National Laboratory, we are developing a disciplined modular approach for both sites that will remove risks early in the process and build to a more rigorous budget and schedule. This rigorous process will be an important and recurring project management theme at the NNSA and across the Department of Energy—in particular, at the Office of Environmental Management.

Controlling and Eliminating Nuclear Materials Worldwide

The FY 2016 Budget Request includes \$1.9 billion for Defense Nuclear Nonproliferation, \$325 million above FY 2015, to continue the critical missions of securing or eliminating nuclear and radiological materials worldwide, countering illicit trafficking of these materials, preventing the proliferation of nuclear weapon technologies and expertise, and ensuring that the U.S. remains ready to respond to high consequence nuclear and radiological incidents at home or abroad, and applying technical and policy solutions to solve nonproliferation and arms control challenges around the world. The Request is a \$75 million, or 4 percent, increase from the comparable FY 2015 enacted level after adjusting for a budget structure change moving counterterrorism efforts from the Weapons Activities appropriation to the Defense Nuclear Nonproliferation appropriation.

We have completed the removal or disposal of a total of 190 kilograms of vulnerable nuclear material, through bilateral agreements, and trilateral agreements with Russia and countries with material of Russian origin. Despite a difficult relationship at the moment, we are continuing to work with Russia to repatriate weapons-usable material to the United States or Russia.

In 2014, we obtained a pledge from Japan at the 2014 Nuclear Security Summit in The Hague to remove and dispose of all highly-enriched uranium and separated plutonium from the Fast Critical Assembly in Japan. We also helped prevent the illicit trafficking of nuclear and radiological materials, technology and expertise by installing 37 fixed and 22 mobile radiation detection systems worldwide.

The FY 2016 Budget Request reorganizes the Defense Nuclear Nonproliferation program into four business lines: Global Material Security; Materials Management and Minimization; Nonproliferation and Arms Control; and Nonproliferation Research and Development. We have also strengthened Counterterrorism and Emergency Response by consolidating these efforts with Nuclear Nonproliferation programs in one account. Together, these reorganizations create a clearer set of business lines for the nonproliferation programs and represent the full continuum of our nonproliferation efforts as we prevent, counter, and respond to global threats.

In FY 2015, the Congress appropriated \$345 million to continue construction of the mixed-oxide (MOX) project at Savannah River. The FY 2016 Budget includes \$345 million, which is the current services projection from the FY 2015 enacted level, while we complete congressionally-directed studies on plutonium disposition costs and alternatives.

Advancing Navy Nuclear Propulsion

The FY 2016 Budget Request includes \$1.4 billion for Naval Reactors, \$142 million above FY 2015, to support the Navy fleet and maintain progress on current efforts to refuel the land-based research and training reactor. The Request increases funding for Naval Reactor's core objective of ensuring the safe and reliable operation of the Nation's nuclear fleet (73 submarines and 10 aircraft carriers), constituting over 40 percent of the Navy's major combatants.

The Naval Reactors programs achieved some significant accomplishments this year. In 2014, we began integrated testing of the lead A1B reactor plant of the next-generation FORD-class aircraft carrier and provided technical resolution support for the nuclear fleet which steamed over 2 million miles.

The FY 2016 Budget provides \$187 million to continue development of the advanced *Ohio*-Class Replacement Reactor, and \$133 million to initiate refueling of the Land-based Prototype reactor. We also provide \$86 million to continue construction of the Spent Fuel Handling Recapitalization Project.

Cleaning up the Cold War Nuclear Weapons Legacy

The FY 2016 Budget Request includes \$5.8 billion for Environmental Management, \$43 million below the FY 2015 enacted level, to position DOE to meet the nation's Manhattan Project and Cold War legacy responsibilities. DOE is responsible for the cleanup of millions of gallons of liquid radioactive waste, thousands of tons of used nuclear fuel and special nuclear material, disposition of large volumes of transuranic and mixed/low-level waste, huge quantities of contaminated soil and water, and deactivation and decommissioning of thousands of excess facilities.

I will discuss in a moment the difficult challenges we face with some of our remaining Environmental Management projects. But I would like to start by pointing out that when the program started, there were 107 sites to be closed, and we have cleaned up all but 16 sites. To be sure, the remaining sites are not the simplest to remediate; however, we started with over 3,000 square miles to remediate, and we're down to only 300 square miles. And so, by some metrics, we have cleaned 90 percent of our total footprint. However, it will be decades before we finish the most difficult remaining sites.

Though we are down to some of the most difficult sites, progress is steady. Last year, we completed demolition of the K-25 facility at Oak Ridge, the largest demolition project DOE has ever undertaken. We have converted 15 million pounds of liquid waste into solid glass at the Defense Waste Processing Facility at Savannah River, enabling closure of six high level waste storage tanks.

We have put forward and are beginning to implement an alternative phased approach to completing the Hanford Waste Treatment Plant (WTP). We have cleaned up 479 square miles of the 586 square mile area at Hanford, including 90 percent of the River Corridor.

Going forward in FY 2016, recovery of the Waste Isolation Pilot Plant in New Mexico is one of our high priorities. The FY 2016 Budget includes \$248 million to implement the WIPP recovery plan, leading to initial resumption of waste emplacement in the first quarter of calendar year 2016. The FY 2016 Budget will also support continued operations of the Integrated Waste Treatment Unit at Idaho and work towards closing the tanks.

With \$1.4 billion for the Office of River Protection, we will move forward on our phased approach to begin vitrifying low activity waste early next decade. The Budget moves forward with construction of the Low Activity Waste (LAW) facility at the Hanford Waste Treatment Plant, including design of a new pretreatment system required for our phased approach. We will also continue technical issue resolution at the site, and we will bring the Plutonium Finishing Plant (PFP) at Hanford, once the highest risk nuclear facility at Hanford, down to slab-on-grade by the end of FY 2016.

Finally, we will continue construction and prepare for commissioning of the Salt Waste Processing Facility at Savannah River, which is on schedule to complete construction by December 2016.

Management and Performance: Improving Efficiency and Effectiveness

Building on the Department's FY 2015 emphasis on management and performance, the FY 2016 Budget moves forward on initiatives that continue to identify and institutionalize improvements across the DOE enterprise.

In the Department's efforts to improve management and performance, we have adopted project management reforms, including strengthening the Energy Systems Acquisition Advisory Board (ESAAB) from an ad hoc process into an institutionalized regular process for situational awareness on project progress and issues, as they arise. ESAAB will be supported directly by a Project Management Risk Committee, which brings together DOE experts for a continuous look at the

risk profile of major projects and issues. We have also taken steps to improve the project peer review process and institutionalize other project management reforms.

We have also continually worked to improve management, increase efficiency, and support diversity on a number of fronts. We have recruited 30 high-level Ambassadors from industry, academia, and nonprofits to increase participation of minorities in energy. We have resolved hiring issues at the Bonneville Power Administration, providing additional Human Resources training and restoring hiring authority. The Department's management and operating contractors have reduced pension plan liability by \$100 million through lump sum buyouts. Our management and operating contractors have also established Health Reimbursement Accounts at 13 sites for their medical-eligible retirees, reducing long term financial statement liability by \$2.8 billion.

Going forward, the Budget includes \$25 million for the Office of the Human Capital Officer to implement a new Human Resources service delivery model to streamline our HR model and eventually consolidate 17 current service centers to five key delivery centers. We will also implement a new Energy Jobs Council to improve calculation of energy jobs data and strengthen technical support for state workforce development programs. We will also continue to strengthen Departmental cybersecurity programs, part of the Cybersecurity crosscutting initiative, through an enterprise-wide cyber council established in 2013 for securing personal data, our nuclear security data, and the privately-owned energy infrastructure.

Advancing the President's Vision: Implementing DOE's Strategic Plan

In conclusion, we have much to do to advance the President's vision and implement DOE's Strategic Plan.

We will continue implementing the President's Climate Action Plan, to reduce emissions at home and around the globe.

We remain committed to our all-of-the-above energy strategy, to encourage innovation, create jobs, enable economic growth, and contribute to domestic manufacturing and net exports.

We must maintain leadership in basic research in the physical sciences—and increasingly in the life sciences, develop the next generation of computation technology, and develop and maintain world-class scientific user facilities.

We will continue to maintain a safe, secure, and effective nuclear weapons stockpile in the absence of testing, and manage the infrastructure needed to meet national security requirements.

We must continue to reduce the global nuclear terrorism threat through measures to identify, control, and eliminate nuclear weapons worldwide.

We will address the legal and moral imperative of cleaning up legacy waste to protect human health and the environment.

We will strengthen DOE and its national missions through cross-cutting initiatives that leverage the science, technology, and engineering capabilities across programs and National Laboratory partners.

And we will continually improve DOE effectiveness and efficiency through project management reform and constant attention to maintaining a safe and secure workplace.

Thank you, and I would be pleased to answer your questions.

As United States Secretary of Energy, Dr. Ernest Moniz is tasked with implementing critical Department of Energy missions in support of President Obama's goals of growing the economy, enhancing security and protecting the environment. This encompasses advancing the President's all-of-the-above energy strategy, maintaining the nuclear deterrent and reducing the nuclear danger, promoting American leadership in science and clean energy technology innovation, cleaning up the legacy of the cold war, and strengthening management and performance.

Prior to his appointment, Dr. Moniz was the Cecil and Ida Green Professor of Physics and Engineering Systems at the Massachusetts Institute of Technology (MIT), where he was a faculty member since 1973. At MIT, he headed the Department of Physics and the Bates Linear Accelerator Center. Most recently, Dr. Moniz served as the founding Director of the MIT Energy Initiative and of the MIT Laboratory for Energy and the Environment and was a leader of multidisciplinary technology and policy studies on the future of nuclear power, coal, nuclear fuel cycles, natural gas and solar energy in a low-carbon world.

From 1997 until January 2001, Dr. Moniz served as Under Secretary of the Department of Energy. He was responsible for overseeing the Department's science and energy programs, leading a comprehensive review of nuclear weapons stockpile stewardship, and serving as the Secretary's special negotiator for the disposition of Russian nuclear materials. From 1995 to 1997, he served as Associate Director for Science in the Office of Science and Technology Policy in the Executive Office of the President.

In addition to his work at MIT, the White House and the Department of Energy, Dr. Moniz has served on a number of boards of directors and commissions involving science, energy and security. These include President Obama's Council of Advisors on Science and Technology, the Department of Defense Threat Reduction Advisory Committee, and the Blue Ribbon Commission on America's Nuclear Future.

A member of the Council on Foreign Relations, Dr. Moniz is a Fellow of the American Association for the Advancement of Science, the American Academy of Arts and Sciences, the Humboldt Foundation, and the American Physical Society.

Dr. Moniz received a Bachelor of Science degree *summa cum laude* in Physics from Boston College, a Doctorate in Theoretical Physics from Stanford University, and honorary degrees from the University of Athens, the University of Erlangen-Nuremberg, Michigan State University and Universidad Pontificia de Comillas.

Chairman SMITH. Thank you, Mr. Secretary.

And I will recognize myself for questions.

And I would like to ask you a series of questions about the Keystone pipeline. Let me acknowledge at the outset, though, that we all know the State Department, because of the pipeline being an international one in crossing countries' boundaries, that the State Department has jurisdiction or has decision-making powers over that particular pipeline. But I know that the Department of Energy has been involved as well. The pipeline has been under consideration now for more than six years. The President vetoed the bill that was passed by the House and the Senate yesterday and, quite frankly, and this is just my opinion, we saw three days after the Senate voted to approve the pipeline a letter sent from the EPA to the Secretary of State raising additional questions. The timing of that letter, coming as it did after the vote by the Senate, raises all kinds of suspicions, and frankly makes me wonder if the President didn't run out of reasons to veto it and was trying to conjure one. You don't need to respond to that. That is just my personal opinion.

But I would like to ask you some questions that I think you can answer. I know there are some questions you cannot, for instance, you couldn't answer questions about the content of conversations or the details of any advice you might have given either the State Department or the President, but my questions I think will help us, and, as I say, I think they are questions you can answer.

And the first question is this: Did you contribute to the State Department's report? And as you know, the State Department found that there was little environmental impact and it would not significantly increase greenhouse gas emissions if the pipeline were built. Without asking you what you contributed, did you contribute to the State Department report?

Secretary MONIZ. As is our custom, the Department provides technical assistance when solicited by—actually by any agency on energy-relevant activities.

Chairman SMITH. Right. And in that case, did you contribute in any way to the EPA's letter to the State Department?

Secretary MONIZ. I don't believe we did, no.

Chairman SMITH. So they did not consult you before the letter was written?

Secretary MONIZ. To my knowledge. We can—

Chairman SMITH. Okay.

Secretary MONIZ. —check that.

Chairman SMITH. Did the White House ask you for your opinion on the Keystone Pipeline? And when I say White House, I distinguish White House from the State Department.

Secretary MONIZ. No, we have had no—certainly no formal request in that sense, but as you say or suggest, clearly we did submit comments to the Department of State.

Chairman SMITH. Right. And do you have any knowledge that the White House asked to the EPA to write a letter to the Secretary of State?

Secretary MONIZ. No, sir, I have no—

Chairman SMITH. Okay.

Secretary MONIZ. —knowledge about that.

Chairman SMITH. And in the report that the State Department produced finding little environmental impact, they did consider the volatility of prices, and yet that was the subject of the letter that the EPA wrote to the Secretary of State. Let me think how to ask this next question. Are you convinced that the State Department did take into consideration the volatility of prices when it came out with its report saying that there would be little environmental impact?

Secretary MONIZ. Well, just to clarify, of course the State Department has not yet acted with regard to environmental impact statement. Again, I cannot be authoritative on what they did or didn't do but I would say that when it was done of course, it was a different price environment for oil. And without—as you suggested, without getting into our comments in a deliberative process, I can say that our comments did, let's say, update on various factors in terms of current oil markets.

Chairman SMITH. Right. And speaking of current oil market, is it your understanding that most of the time when prices go down that production oftentimes goes down as well?

Secretary MONIZ. With some time lag that happens because we know capital expenditures are typically down, say, 30, 35 percent right now—

Chairman SMITH. Right.

Secretary MONIZ. —in the low-price environment.

Chairman SMITH. Right. I say that because the letter from the EPA to the State Department mentioned volatility of prices as a reason to take another look and suggested that that would actually increase environmental impact.

The letter ignored two things. It ignored the fact that the State Department had found little environmental impact and it ignored the fact that, as prices go down, production sometimes decreases and therefore, whatever environmental impact there would have been would be diminished by lower prices, not increased. And so the letter from the EPA seemed to be off the tracks for a couple of reasons.

And again, you don't have to agree with me on that. That is simply my conclusion, but I am very suspicious of the letter that the EPA wrote. It doesn't seem to have any real grounds or any real basis or any new issues that are raised, and—

Secretary MONIZ. It—

Chairman SMITH. But do you have a comment on that?

Secretary MONIZ. Yes, if I may comment, first of all, the EIA projection for our domestic oil production in 2015 is that it will be higher than in 2014.

Chairman SMITH. Right.

Secretary MONIZ. So the CAPEX reductions are more future and that in turn will depend upon what actually happens.

Chairman SMITH. Right.

Secretary MONIZ. In fact, the prices have come up, as you know, since it happened—

Chairman SMITH. Right—

Secretary MONIZ. —already have come up \$10 or so.

Chairman SMITH. Right, and the point is—

Secretary MONIZ. And so—

Chairman SMITH. —they are going to—

Secretary MONIZ. And the other thing, if I may say, is the other factor of course is that, as the prices come down, first of all, it is a boon to our consumers—

Chairman SMITH. Right.

Secretary MONIZ. —across the country and perhaps in other places, again, without going into too many things, the lower global oil price, may have an effect in terms of helping the European economy, which has been extremely soft of course—

Chairman SMITH. And, as you say, the consumer benefits. My point was only that is taking the volatility of prices into consideration, well, the State Department had already done that, so again, the EPA letter didn't raise any new issues, and that is just my take on the letter.

Secretary MONIZ. Well, the State Department issue had just kind of not in a deep way talked about—I forget exactly. I think they commented on what would happen if the price went down into \$75—

Chairman SMITH. Right. Right.

Secretary MONIZ. —or something like that and—

Chairman SMITH. Totally—

Secretary MONIZ. —which is still high compared to where we are today.

Chairman SMITH. Thank you, Mr. Secretary. And my time is way over.

The gentlewoman from Texas, Ms. Johnson, is recognized for her time.

Ms. JOHNSON. Thank you very much, Mr. Chairman.

Secretary Moniz, something I think that my colleagues and I on both sides of the aisle can agree on is the critical link between energy and water. As you probably know, last year I introduced bipartisan legislation with my good friend and former Chairman of this Committee Ralph Hall to help address this issue, so I am very interested that in your budget request this is highlighted over and over again as a Department-wide priority. Can you provide a general overview to the Committee on the Department's efforts in this area, including the activities of the Energy and Water Tech Team you established?

And the second question is where do you see the potential for the biggest payoff for this research in this area?

Secretary MONIZ. Thank you, Ranking Member Johnson. Well, first of all, because I was very pleased to discuss the energy-water developments with you a year ago, and appreciate your leadership in this area. So, as you know, other Members of the Committee may not be aware that last year we published, and we have posted a significant report—I think it is about 150 pages—in terms of a detailed technical analysis about the issues of the energy-water nexus. These are becoming increasingly important.

It is also clear that there are major responsibilities in that area, water, and other departments and we do coordinate, but there are some areas where we think the energy implications really have a strong focus. For example, in answer to your question, one of the focuses is on the use of what you might call nontraditional waters

in energy systems. That would include, for example, the use of flow-back waters in other ways. That is just one example.

Another example is in lower energy water utilities, for example. We have quite a bit of energy used in terms of conveyance, for example, of water. Desalinization is another example. So these are the areas that we proposed a \$38 billion crosscutting budget for that. Those are examples of the technology areas that we will explore.

I may add one other very important point I think, and that is we have a number of collaborations with international partners, and one of them is through the Clean Energy Ministerial, for example, involves about 20 countries, and others are more bilateral like China, for example. So they are—let's say with China, we have a Clean Energy Research Center collaboration. We provide \$10 million a year. That is matched threefold for a \$40 million issue. Our money is spent on American researchers for collaborative projects. But my point is that in all of these venues when we say how about if we add the energy-water nexus to our collaborative focus, it is 100 percent yes, very important. So this is a global issue. We had our domestic issues but it is also a global issue in terms of the energy-water nexus.

Ms. JOHNSON. How will these investments impact the resilience of our nation's energy infrastructure?

Secretary MONIZ. Again, very, very important. We do have a report that we can look at in terms of—not surprisingly, for example, much of our critical energy infrastructure is in coastal regions. That is one clear example. And as we are seeing with global warming, with warming of our oceans, we are seeing dramatically increased storm surges. That is just one example of how the energy-water nexus and our energy infrastructure are tightly linked.

Ms. JOHNSON. Thank you very much.

Very quickly, many times we talk about picking winners and losers. Should the Department support all research proposals in areas equally or should it prioritize investments based on where we can get the most value for our taxpayers' dollars?

Secretary MONIZ. No, we clearly have to emphasize priority areas and of course we think we do that in a thoughtful way. But then within those areas of course when it comes time to making awards, then we have to be open to competition to select those. And in some cases—I will give you an example—in, let's say, the—going back to ARPA-E, when we have our open solicitations, we end up being able to support the order of 1 or two percent of the interest, so we have a big opportunity for more innovation support in this country.

Ms. JOHNSON. Thank you very much. My time is expired.

Chairman SMITH. Thank you, Ms. Johnson.

The gentleman from Texas, Mr. Weber, is recognized for his questions.

Mr. WEBER. Thank you.

Secretary Moniz, interesting question, if you had to hazard a guess, would you say that a reduction in the funding of research in green energy or a reduction in the funding of climate change would have the most detrimental effect on national security?

Secretary MONIZ. They are very tightly linked in my view and I really can't distinguish between the two there.

Mr. WEBER. Okay.

Secretary MONIZ. They are both central.

Mr. WEBER. So would an increase in funding research for nuclear energy waste storage, help us with national security?

Secretary MONIZ. Well, in the sense that it advances a very important source and a low-carbon source, yes, and in fact our budget request does have a significant increase for waste storage activities.

Mr. WEBER. Now, let's contrast those two. Having your druthers, increase in research on spent fuel storage for nuclear energy versus a reduction, for example, an increase in funding research for climate change, which of those two would you say is the most important to national security?

Secretary MONIZ. Well, again, in our budget we have made a set of priority choices within reasonable funding constraints, and obviously we think that it is a good balance and we have a substantial increase in the nuclear waste arena and we have a strong program in terms of our part of the Administration-wide Global Climate Change Research Group.

Mr. WEBER. Given the current world climate with a lot of terrorism going on, I guess you would probably agree it is kind of hard to power a tank with a solar panel, or a jet airplane?

Secretary MONIZ. Obviously there are different energy sources fit to different purpose. That is what a portfolio is all about. But I would stress of course that many different kinds of groups have supported the idea that climate change has enormous national security implications, and that includes many four-star—retired four-star generals and admirals. And I fully support that position.

Mr. WEBER. Sure. In terms of energy and nuclear research and having a strong, reliable, affordable energy source, nuclear energy will help that right now and we need a lot of good clean energy right now. Would that be your assessment?

Secretary MONIZ. We strongly support nuclear as a part of the portfolio.

Mr. WEBER. Okay.

Secretary MONIZ. And if I may add, Congressman Weber, that not only is having a stronger nuclear industry in this country important for clean energy, but it is also important for national security and that it gives us a stronger platform for advancing our non-proliferation goals.

Mr. WEBER. So I take it you are a supporter of Yucca Mountain?

Secretary MONIZ. No, I consistently have said, the Administration has said we don't think it is workable. This is based upon the fact that I think the evidence is very strong. As—the Blue Ribbon Commission pointed out that you need a consent-based process to get over the finish line.

Mr. WEBER. Are you familiar with how much money has been spent on Yucca Mountain and how much money is in reserve for Yucca Mountain?

Secretary MONIZ. I believe the total spent over the years is something like \$15 billion, and the waste fund currently has 32, \$33 billion or something like that.

Mr. WEBER. Billion dollars, that is right.

Secretary MONIZ. Correct.

Mr. WEBER. What is the answer for nuclear waste energy storage if you are not a proponent of Yucca Mountain?

Secretary MONIZ. Well, first of all, the answer starts with consent-based processes. And there we have strongly supported the idea of moving to—at least starting with pilot-scale storage facilities and we need Congressional authorization for that, and of course I think you know in Texas there has been a recent proposal for a commercial storage facility, which is very interesting, and we look forward to talking with the supporters of that project.

Mr. WEBER. Are you familiar with the Waste Control Specialists in Andrews County, the low-level radiation storage facility?

Secretary MONIZ. Yeah, yeah, the WCS. Yeah, absolutely. And in fact, we have stored waste there.

Mr. WEBER. Okay.

Secretary MONIZ. Yeah.

Mr. WEBER. How about LNG exports? You know, America's boom in shale gas exploration and production is allowing us to increase our supply and enhance our energy independence. We have the ability to export LNG gas to customers overseas. I have two LNG export facilities in my district. One has broken ground but the other is still lingering with the DOE after having filed its application in October 2012. Why has it taken such a long time for the DOE—why are they delaying these projects do you think?

Secretary MONIZ. First of all, let me clarify. We are not delaying these projects. Frankly, we have no projects right now to act upon because these projects have not had their EIS go through FERC. So we have approved several projects for 5.7 BCF per day. There are three under construction actually. The first will begin exports in roughly a year I expect, maybe a bit less, they say maybe into this year.

But we have made it very clear that, especially with our revised process, that when we have the information that we need for a National Interest Determination, and that includes having the Environmental Impact Statement, which we don't do; that is done at FERC. When the last one came to us, we responded to that in less than 1 day. So when the EIS's are ready and we have all of the data that we need for a National Interest Determination, we have been very, very prompt.

Mr. WEBER. Okay. Well, I am sorry but I am out of time. I am going to yield back. Thank you, Mr. Chairman.

Secretary MONIZ. We would be happy to follow up with you on that if you would like.

Chairman SMITH. Thank you, Mr. Weber.

The gentlewoman from Maryland, Ms. Edwards, is recognized for her questions.

Ms. EDWARDS. Thank you, Mr. Chairman.

And thank you, Mr. Secretary, for being here today.

I want to follow up on the conversation around nuclear energy because my understanding is that we held a hearing on the future of nuclear energy back in December, and we heard from a number of witnesses about cutting edge nuclear reactors and technologies. So I was a little surprised that your budget includes a cut to the advanced reactor program by 25 percent so I want to ask about that.

But I have mostly been really interested because I—you know, for the most part, if you hear me here on this Committee, I wear my environmental hat. I share the concerns of a lot of our communities about waste and storage, about access to—you know, to plutonium, et cetera, as we all do, but I have been hearing more about small nuclear reactors that—modular reactors that are not plutonium-dependent, which I think if there were some research in that area, it actually could potentially help us bridge this gap between the—you know, sort of the big opposition and the need for additional energy sources. And so I wonder if you could tell me about that and what the Department envisions in terms of ramping up the research in that area?

Secretary MONIZ. So, first of all, you are referring to small modular reactors. We think this is a very important direction, and in our budget we have proposed a modest increase from 54 to \$62 million. There are two prime things in regard to SMRs. I should emphasize that the ones that are being pursued right now are based upon light water technology, so these are not revolutionary changes—

Ms. EDWARDS. Right.

Secretary MONIZ. —in reactor structure but there are some significant ones, without getting into details, integral reactors.

We are supporting a company called NuScale that won a competition—

Ms. EDWARDS. Um-hum.

Secretary MONIZ. —and they are expecting to go to the NRC for licensing at the end of 2016 and the hope is that they will have an operational reactor in, say, 2022, something like that.

We are also supporting the move towards a siting of a second kind of small modular reactor, so we are advancing on that. And I think it is very important that we have one or preferably more operating in the first half of the next decade because that is when the utilities are going to have to start making big capital decisions for a next round of nuclear power. So that is one thing.

With regard to research, there was a fiscal year 2015 one-time funding for some industry-led advanced reactors, so we think that this is actually going to be a healthy research budget. We have a strong focus on nuclear fuel issues, important for safety, and we just renewed our innovation hub based out of Oak Ridge, which is very successfully developing advanced computational tools for nuclear reactor design and safety.

Ms. EDWARDS. And so what—part of what I am trying to understand—and I have to tell you I am really not there yet but I am curious. And part of what I want to understand is whether it is possible that there is—there are research dollars put into advancing technologies that take away the concern that we have about proliferation, that take away the concerns that we have about waste and disposal, and that take away concerns we have about being able to operate in places where you are essentially kind of off the grid. And if those things can be true or if that is part of the investigation, I think people like me might think a little bit differently of that nuclear technology.

Secretary MONIZ. First of all, in the budget there is an increase proposed for fuel cycle research and development, which is I think very relevant to your issue of plutonium—

Ms. EDWARDS. Right.

Secretary MONIZ. —management. Clearly, we want to minimize that. There are potentially very advanced fuel cycle technologies that can “burn” transuranics.

Ms. EDWARDS. Right.

Secretary MONIZ. Those are to be—in my view, those are decades away from being credible commercial possibilities. I think it is very important to pursue them. I might just link that to our commitment to what is sometimes called interim storage of spent fuel from the point of view that I believe that is the most important next step for beginning to move the fuel. But importantly, if we have that for century scale, it also preserves our options for possible future advanced technologies of that type.

Ms. EDWARDS. Thanks very much. Thanks, Mr. Chairman.

Chairman SMITH. Thank you, Ms. Edwards.

The gentleman from Texas, Mr. Babin, is recognized for his questions.

Mr. BABIN. Thank you, Mr. Chairman.

Mr. Secretary, the federal government is currently facing an extreme budget constraint. In light of the current budgetary crisis, how should we prioritize energy research and development activities to maximize the impact on technology development and the overall energy system?

Secretary MONIZ. Well, again, clearly our Administration request we think does reflect an appropriate set of priorities. We do propose a substantial increase in our energy technology development. Again, it is convenient for me to refer to this week’s American Energy Innovation Council report, again, very prominent—not energy CEOs; these are prominent CEOs from other sectors who repeated what was said in a National Academy reported 2005, what they said three, four or five years ago, that we are probably under-investing in energy technology overall by as much as a factor of three. That is their number.

Mr. BABIN. Okay. Specifically though, please compare and contrast the value of basic and early-stage foundational research to late-stage deployment and commercialization activities.

Secretary MONIZ. Well, we think we have to work across the entire innovation chain. Because we are looking at the introduction of these new technologies at different timescales, some like in this decade, some in the next 10, 20 years, and then some way down the road, some of the nuclear thing I just mentioned, for example, way down the road. So those require work at the different parts of the innovation chain. So we have everything from, let’s say, Energy Frontier Research Centers, which we think is an incredibly successful program on the basic research side for the enabling science for new energy technologies of the future all the way to things like our loan program, which are on the deployment side, which by the way is a program that is actually in the black and has really stimulated technology deployment that is pushing the technology envelope.

Mr. BABIN. Okay. The budget requests a 42.3 percent increase in the Office of Energy Efficiency and Renewable Energy. That is over \$800 billion in new spending. This is an enormous increase in an office that focuses on late-stage commercial applications, not basic research in universities and national labs. By contrast, the budget for the Office of Science, which funds basic research, increases by only 5.4 percent in the budget request. Are the Office of Science's basic research programs a lower priority for this Administration when compared with these renewable programs?

Secretary MONIZ. No. Our Office of Science request I think is a very strong one. As I said earlier, it fully supports, for example, our development of the major tools in our national laboratories that serve the entire research community. But in addition to the construction, it is a full operation budget. We estimate that it will fund 98 percent of the full operation of our entire suite of facilities. Partly that is because the Office of Science I think has done an outstanding job over the years in how it phases its projects so that as some projects are rolling off, others are coming in. And so with a, you know, five percent budget, for example, increase in this case, I think it meets those needs.

Mr. BABIN. Okay. Well, right along those same lines, if we have a 42 percent increase, can you provide additional information on the goals the President hopes to accomplish with such a sizable increase to the program budget?

Secretary MONIZ. Yes. And let me if I may, make a couple of points. One is that the energy efficiency renewable energy budget I showed, first of all it can be thought of as really three budgets. There is an Energy Efficiency Program, a Renewable Energy Program, and a Sustainable Transportation Program, and they are not so different in their amounts, number one. Number two, we should remember that in that category, for example, take energy efficiency, let me highlight two parts. One is that is where we put the big focus on assisting advanced manufacturing for the future, things like 3-D printing, et cetera. Secondly, not in the R&D space we have a \$230 million proposal with a substantial increase from I think \$180 million for weatherization, so that is direct assistance to people with fewer resources obviously for weatherization. So, you know, I think we have to look at the different things that are happening there.

Similarly, in fossil energy, for example, part of it is R&D, part of it is things like managing and upgrading the Strategic Petroleum Reserve. So these are not all R&D programs.

Mr. BABIN. Okay. Thank you, Mr. Secretary.

Secretary MONIZ. Thank you.

Mr. BABIN. And thank you, Mr. Chairman.

Chairman SMITH. Thank you, Mr. Babin.

And the gentlewoman from Oregon, Ms. Bonamici, is recognized for her questions.

Ms. BONAMICI. Thank you very much, Mr. Chairman, and thank you, Secretary Moniz, for coming back to the Committee and sharing your expertise on these important issues.

This Committee has had many discussions about our nation's energy future. It is an important part of what we do.

Well, the district I represent in Oregon is home to a variety of renewable energy companies that are helping lead the way to a clean energy economy. I am glad to see strong support for renewables in the President's budget.

From solar manufacturers like SolarWorld and wind turbine companies like Iberdrola, Oregon companies are really leading the way to a renewable future and it is important for us to support those efforts.

I mentioned SolarWorld. It is an important employer in the district. They make a high-quality solar panel and, unfortunately, there have been low-cost solar panels that have been flooding this country from China. It has made it difficult for the playing field to be level for companies like SolarWorld. And they have made some progress with trade cases.

But I wanted to ask you, Mr. Secretary, in your written testimony when you talk about implementing the Department of Energy's strategic plan, you say "in remaining committed to the all-of-the-above energy strategy, encouraging innovation, create jobs, enable economic growth, and contribute to domestic manufacturing and net exports." So I would like you to address how the Department of Energy's budget will support domestic manufacturing of renewable energy products so that it is U.S. companies, not Chinese companies, that are building our clean energy future.

And specifically, how does the Department's SunShot Initiative provide assistance to U.S. solar manufacturing companies and what percentage of the dollars are used for domestic manufacturers?

Secretary MONIZ. Well, of course, first of all, the entire amount is for domestic activity in manufacturing. And I might add that—just in starting that in addition to the funds that are explicitly labeled for solar like SunShot, there are other very important activities that are indirectly supporting this. For example, our very first manufacturing institute hub is on wide-bandgap semiconductors, power electronics. Power electronics are a very important part of a solar PV system, so those aren't even counted directly as solar that support the manufacturing future in this area.

Indeed, the SunShot program, which works across the whole spectrum of requirements for solar systems actually has our most substantial increase proposed for what are sometimes called the balance of plant and soft costs, and this is because we have had so much success. DOE has helped with the private sector in reducing costs that our solar module costs are well below a dollar per watt and the Holy Grail has always been 50 cents a watt. I believe we will meet that within two or three years domestically. So now, ironically, it is no longer the solar module that is driving the cost as it is things like the inverters and these other costs.

So the SunShot program is across the board looking at that, as are our other manufacturing programs.

Ms. BONAMICI. Thank you. I would like to get maybe some more specific information about—

Secretary MONIZ. Be happy to.

Ms. BONAMICI. —the percentage of dollars—

Secretary MONIZ. We would be happy to, yeah.

Ms. BONAMICI. —that go to domestic companies but—

Secretary MONIZ. Yeah.

Ms. BONAMICI. One of the issues that we have talked about before, a technology that deserves further research and discussion is marine hydrokinetic energy. The waves off the coast of Oregon, for example, provide a large amount of potential energy, and I know that the DOE has estimated that 20 percent of our nation's power by 2050 could come from hydrokinetic systems. So I know your agency supported the Pacific Marine Energy Center and the Northwest National Marine Energy Center for which we are grateful, but I remain concerned that the federal R&D funding for wave and other marine energy sources is not sufficiently supporting the development process for technology. Can you comment on the agency's work on wave energy and how this year's budget helps advance it to a place where can reach its full potential?

Secretary MONIZ. Well, I believe that we have approximately \$40 million for hydrokinetic activities and a smaller amount for other hydro activities. So hydrokinetic is nearly 2/3 I believe of the water energy budget. With the fiscal year 2016 budget we will be moving towards supporting important open ocean demonstration projects, which we think is an important next step to take.

Ms. BONAMICI. Thank you very much. And I see my time is just about to expire. Thank you. I yield back.

Secretary MONIZ. Thank you.

Ms. BONAMICI. Thank you, Mr. Chairman.

Chairman SMITH. Thank you, Ms. Bonamici.

The gentleman from Arkansas, Mr. Westerman, is recognized for his questions.

Mr. WESTERMAN. Thank you, Mr. Chairman.

Mr. Secretary, I appreciate your testimony today. You talked about energy portfolio and I agree we need a reliable, diverse, and an economical domestic energy portfolio and domestic energy supply. And as we look at the spectrum of energy opportunities out there, we have to look for a balance among economics, diversity, reliability, and the domestic supply.

So when we look at conventional fuels on one end of the spectrum to renewables and our alternative fuels on the other end of the spectrum, from an economic standpoint, the conventional fuels outperform the renewables and alternative fuels on the economic scale. So when we look at priorities and the climate that we are in today where we are seeing a decrease in pricing in conventional fuels, and you talked about priorities and investing in research.

Let's look at a bigger picture in priorities in the whole energy spectrum. We invest a lot of money in this country for subsidies to make renewables and alternative fuels more competitive on the economic scale with conventional fuels, and as the price of conventional fuels gets lower, the cost of those subsidies to make the playing field level between renewables and alternative fuels and conventional fuels, it takes more subsidies and more cost to do that.

So my question to you is wouldn't it makes sense to invest less to subsidize inefficient and uneconomical demonstration and production technologies and to rely more heavily on conventional fuel supplies while at the same time investing more in research so that in the future these renewables and alternative fuels would be more competitive with the conventional technologies?

Secretary MONIZ. Well, thank you. First of all, I keep repeating and saying that we are committed to the all-of-the-above strategy and I am happy to elaborate on that more, number one. And two is I would be happy to supply or suggest that you or your staff look at our website for a small publication called “Revolution” now that provides the facts on where we have come in terms of costs of things like wind, solar, LEDs, vehicle batteries; it is hard to keep up sometimes with the cost reductions of these areas. They are getting a very, very competitive.

Third, we should understand that there are subsidies, direct or indirect, pretty much across the board. Certainly, there are some tax credits for renewables. We are proposing these tax approaches on carbon capture, sequestration. There are vehicles such as master limited partnerships which only apply to fossil areas and that provide favorable tax treatment. So there are a whole set of approaches that encourage everything from midstream fossil production to renewables and efficiency.

Mr. WESTERMAN. And I understand the costs are getting lower but they are still not as competitive as conventional fuels, and hopefully someday we will see those costs as low as conventional fuels. But in looking at your budget, you have got a significantly higher amount of research dollars for renewables than you do for conventional technologies.

And also there is the FutureGen project where you have recently announced you are suspending the development activities and we have already spent \$200 million on that project. That seems to me like it is moving away from, you know, a broad and diverse energy portfolio.

Secretary MONIZ. Well, first of all, in terms of the budget facts, the fiscal year 2015 renewable energy budget is \$456 million. The fossil energy R&D budget is \$561 million. So it is actually a larger budget in the fossil.

Secondly, if I look at the FutureGen, let me first of all say right off the bat that that was not a very fortunate result. I still believe that the technology of FutureGen, including oxy-combustion of coal and then sequestration in a saline aquifer is an area that we must explore. However, because they were delayed, there was litigation, there were various reasons, they were delayed and the hour of funding deadline is running out and there was no way that they could complete all the activities and so we had to stew with taxpayer dollars. We are going into structured closeout and we will protect what we can of that, including the IP for the technology and we do own pore space for future—hopefully future CO₂ sequestration projects.

Mr. WESTERMAN. And so let me clarify, on the energy efficiency and renewable energy line item, it is significantly higher than the other item with those two combined.

Secretary MONIZ. But if I may again say that the EERE budget line is really three budgets. There is an Energy Efficiency Program, a Renewable Energy Program, which is quite different, and a Sustainable Transportation Program. And I can give you—the numbers are 642 for efficiency—fiscal year 2015—456 for renewables, 602 for transportation. Nuclear energy is 833, fossil energy, only R&D is 561. So these are frankly basically comparable budgets.

Mr. WESTERMAN. Okay. Thank you, Mr. Chairman.

Chairman SMITH. Thank you, Mr. Westerman.

The gentleman from Florida, Mr. Grayson, is recognized for questions.

Mr. GRAYSON. Thank you, Mr. Chairman.

In any part of the federal budget, the best indication of what we are spending this year is what we spent last year. The correlation is extremely high. What you are doing with the fiscal year 2016 request seems to be something fundamentally different. For instance, you are making increases as much as 84 percent in your proposal for one area, decreases as much as ten percent in a different area. I see the numbers but what I don't see is the concepts. Tell me what is leading you to make the decisions that you are making here in these proposed amounts.

Secretary MONIZ. Well, first of all, I thank you for pointing out that, yeah, we do not do a peanut butter approach. We do a prioritization as we propose our budget. There are several factors. Of course we are looking as to where it is—where are we ripe in some sense for having breakthroughs from basic research to deployment? That is one feature.

Secondly, we make no bones about it; we are clearly doing a prioritization within the all-of-the-above strategy for a low-carbon future even as we support areas in transportation and areas in—for example, in the budget that you brought forward for fiscal year 2016 we would start a natural gas plant sequestration approach because while natural gas is carbon light among fossil fuels, eventually we are going to need carbon capture there as well.

We are doing crosscutting activities such as—I think this is really important—in our fossil energy budget this year is supercritical CO₂ thermodynamic cycles, which can apply to fossil fuel plants, nuclear plants, geothermal plants, so across the board.

So we have an extensive process. We use our national laboratories as part of our, you know, technology thinking in terms of how we prioritize and how we structure programs.

If I may say another one that crosscuts is our subsurface science and technology where the theme is how do we manage the subsurface—fractures, permeability, et cetera—for everything from carbon sequestration to hydrocarbon production to engineered geothermal, et cetera? So that is the way we think this through. This is—I hope it reflects a thoughtful approach to our prioritization.

Mr. GRAYSON. I think you have authority, at least limited authority to move money from one category to another. If so, how did you use that authority this past year?

Secretary MONIZ. I could not give you here a detailed accounting. We can supply that. But our authorities are fairly limited and frankly you won't be surprised if you sit where I sit I think there are often too many control points in the way the budget appropriation is put forward. But I would be happy to respond more—in a more detailed way if you would like.

Mr. GRAYSON. All right. You mentioned that one of the motivators for this kind of proposed budget change is whether an area is ripe for breakthroughs. Can you give some examples of where you believe that there is a ripeness for breakthrough and where you are putting in or would like to put in more money?

Secretary MONIZ. Well, one place where we did have a strong emphasis already in the budget is in the manufacturing technologies, advanced manufacturing technologies that are very ripe. If I may give you one example there, 3-D printing.

So first, we collaborated with the Department of Defense. We were the smaller investor, not surprisingly, in a 3-D manufacturing institute in Ohio but we also had more of a research-oriented 3-D printing facility at Oak Ridge. That facility in turn collaborated with a small startup auto company called Local Motors. You may have seen this last year. They printed the first car. And now, just two weeks ago at the ARPA-E Summit, that small company was there and they are talking about next year allowing you to go in, pick the car you want to have printed, and go back 12 hours later and pick it up. But that is kind of exciting and shows a great technology opportunity.

If I go to basic research, a prime example I would say are the Energy Frontier Research Centers. We are funding now over 30 of them. Unfortunately, that is down because initially the ARRA funding gave us a big leg up. With that gone now, we have gone down from 46 to 32 or 33. But those are having great impact. They again are looking at the basic science challenges for the next generation energy technologies, and we have strong support for those in the budget.

Mr. GRAYSON. How fast did the car go?

Secretary MONIZ. I don't know but I believe it can take you at plenty—

Mr. WEBER. Let me tell you, it was nice and fast. I rode in it.

Secretary MONIZ. It—yeah, okay, good. It depends whether you choose the electric version or the internal combustion engine version.

Mr. GRAYSON. Did you let Randy drive that car?

Secretary MONIZ. It wasn't my car.

Chairman SMITH. Thank you, Mr. Grayson.

The gentlewoman from Virginia, Ms. Comstock, is recognized.

Mrs. COMSTOCK. Thank you, Mr. Chairman.

I am from Virginia so, you know, certainly our state is very involved with coal and I am very concerned often about the EPA regulations and how they are impacting us and, you know, universally, you know, hear concerns about that.

So in light of some of the proposals there and the cutback in clean coal technology, I was wondering, are you working with EPA so that they aren't putting onerous burdens on, you know, coal companies depending on things that may or may not go forward and be invested in and happening? How can we coordinate this better so more science is being used from the Energy Department before the EPA is making their decisions? Because oftentimes, you know, then they are coming to us, they are coming to local governments. I know in some cases we had requirements that had to be killed at the local level or lawsuits and that requires a lot of economic displacement, anxiety. You know, how can we make sure they are coming to you first and having the science before they are making these onerous regulations?

Secretary MONIZ. Well, several things to say there. First of all, I want to make it clear that we are not backing away from our

clean coal approaches. Again, we have explicit R&D programs there. We have still, despite the FutureGen—which was referred to earlier—activity, we still have a very strong portfolio of carbon capture and sequestration projects. We have an \$8 billion loan guarantee solicitation for fossil projects that lower emissions, and we have, as I already alluded to—not at DOE but in the Administration—the proposal for tax credits for carbon capture and sequestration. So we have a very strong portfolio of programs supporting coal.

With regard to your statement about the EPA regulation, proposed regulation, first off, let me say that we do do technical, you know, consultation with the EPA but, you know, I think there is sometimes a little apples and oranges. The projects that we advance from the Department of Energy not surprisingly are pushing the edge, so when we do a carbon capture utilization sequestration project, we are pushing, you know, 90 plus percent capture. If you look at the proposed EPA 111(b) rule for new coal plants, if you build an ultra-supercritical plant, a very high-efficiency plant which exists, the EPA proposed rule requires only 30 percent capture. That is a much lower impact and in fact the impact is significantly lower than the numbers other often talked about because it is really a much smaller partial capture requirement.

Mrs. COMSTOCK. Okay. I want to submit a few more questions on that front—

Secretary MONIZ. Sure.

Mrs. COMSTOCK. —but I did want to ask another totally different area on fuel cell technology, and can you just give us a little bit of update on what is going on there, what are the expectations there going forward, and—

Secretary MONIZ. Yes.

Mrs. COMSTOCK. —what particulars do you have—

Secretary MONIZ. Right.

Mrs. COMSTOCK. —going on there?

Secretary MONIZ. Again, I have forgotten the exact number but we have a significant increase proposed in our fuel cell program. Fuel cells are another technology where the costs have been coming down very, very dramatically. I think the Department of Energy was certainly part of that. That is true, by the way, both for stationery and for mobile sources.

And one indication of the success may be, you know, indirect but is that if you went last month to the Washington Auto Show, it was remarkable. There were four different companies that had fuel cell vehicles on the floor and including there is now commercially available a fuel cell car. It is not yet \$20,000 but it is only—it is “only” \$57,000 for a really nice fuel-cell vehicle car. That is a dramatic cost reduction. In fact, right now, the way those costs are going, again, the fuel cell costs are coming down.

We have to manage the hydrogen fueling infrastructure, however. And right now, it is really only in California where one sees that to a certain extent, although the companies are looking to collaborate to do the same thing next in the Northeast. But fueling infrastructure, hydrogen fueling infrastructure is something we really have to think about how that goes forward.

Mrs. COMSTOCK. Okay. Thank you, Mr. Chairman.

Chairman SMITH. And thank you, Mrs. Comstock.

The gentlewoman Ms. Esty is recognized for her questions.

Ms. ESTY. Thank you, Mr. Chairman, and thank you, Secretary Moniz, for your presence here and answering our abundant questions.

I wanted to return a little bit to the advanced manufacturing institutes. That is something that is of enormous interest in my State of Connecticut, which has a tradition there. I just saw a small toy company last week that is using 3-D printing for American-made toys that meet safety standards, so there is exciting work being done.

Can you expand a little bit on what you have learned so far from the four institutes that are out there, what these two additional ones are looking to—if that is looking to augment the program overall or if they are specific around clean energy that you are hoping to find more information on?

Secretary MONIZ. Thank you. Well, first of all, there are only two that are actually established, the wide-bandgap semiconductors and the composite materials. That was just announced in January. It is not even set up yet actually. There is actually only one that is functioning right now. We are in the process of making an award hopefully not too far down the road on a smart manufacturing one and we have a fourth where we are going through the process of deciding, you know, what is the area, consultations, et cetera, what will be the focus area. And then we propose two more. So that is one point.

Secondly, given where we are, frankly, the outcomes are not yet evident because we only have one that has been operating now for less than a year. But if I make an analogy, again, I take ARPA-E, that in 2009 with ARRA funding, that program got kick-started, and as I said earlier, now five years later we can now judge outcomes. And we didn't sit around without investing more in that as we went forward. It is very important; we have got to stay on top of it to identify problems early on if we need and make midcourse corrections if needed. With ARPA-E, fortunately, it has been kind of clear sailing. As I said, now with the five-year mark, we are seeing very—you know, I think very impressive outcomes. We predict the same for the manufacturing institutes.

Ms. ESTY. And just very briefly because I have got a couple of other questions, you talked about the measurement. There is both the question of how you judge the metrics and over what time period because if you are looking at more basic research, obviously you need a longer time frame in order to judge that. So for something like these manufacturing institutes, how do you handle that sort of connection between basic research taking longer and trying to decide when you apply those metrics—

Secretary MONIZ. Right.

Ms. ESTY. —for success?

Secretary MONIZ. Well, so I think here we will see some metrics that are—we can look at it much earlier. For example, one component of these will in a certain sense be technology transfer to small- and intermediate-sized companies. That is something we should be able to see within a couple of years there. So again, if I take the 3-D printing—I gave an example; I won't repeat it—on

the printed car that is an example where we are seeing amazingly rapid effects, and that was in collaboration with our Oak Ridge laboratory, I mentioned the little car company but I didn't say there is also supply chain. For example, the printers were developed in Cincinnati, et cetera.

Ms. ESTY. And changing gears, can you talk a little bit more about the security of the grid, reliability and resilience? We have had a number of hearings here. I am also on the Transportation Committee, a great concern there. Looking at—you know, you have a relatively small budget allocated for this. Can you explain, you know, what role you think you play at the grid level? I know you are looking at distributed generation and obviously the battery technology that permits more distributed generation will be important for resilience and reliability. But if you can talk about how you made those decisions and what we should be looking for, cybersecurity, the attacks on the grid in California.

Secretary MONIZ. So the grid modernization proposal, first of all, is \$356 million, and I said that will be further amplified or justified if you like in the Quadrennial Energy Review coming out. We approach this by looking at the spectrum of threats. To address resilience or energy assurance, we look at extreme weather of which we expect to see more, including, I mentioned the storm surges with warmer waters, et cetera. Cyber threats, physical threats—I think you were alluding to the California incident, for example—we look at geomagnetic storms, which have impacted our grids. It is kind of a low probability, high-risk issue. So we are looking at that resilience in many ways. One way is that we have supported and will support now the integrated—to capture the value through data integration and fusion of the kinds of new data that we are collecting and supporting, phase data, et cetera. That is one example.

I could go on with more on that and would be happy to do so, but just given the time, let me switch and say but in addition to those kinds of significant budgetary requirements to develop the technology base, the modeling base, the system integration base, all the way from the high-voltage grid to the distribution system, but in addition there are other activities we have, very important, that are not budgetary items. For example, we run—the Deputy Secretary chairs a group of utility CEOs who meet regularly, quarterly, specifically on cyber threats to the system and we have taken steps such as selectively giving security clearances, for example, to some of those to be able obviously to share very sensitive data.

So it is kind of a full spectrum approach. This is very serious. The attacks are just increasing in frequency and we are very, very mindful of our responsibilities there.

Ms. ESTY. Thank you very much.

Secretary MONIZ. We could give a more—in a different setting a more detailed briefing.

Chairman SMITH. Thank you, Ms. Esty.

The gentleman from Washington, Mr. Newhouse, is recognized for his questions.

Mr. NEWHOUSE. Thank you, Mr. Chairman.

Thank you, Mr. Secretary, for being here with us.

Hanford is in my district and like many people in the rest of the country, we were very proud to be able to contribute to winning

World War II, winning the Cold War, but as we move forward with these exciting new technologies that we have talked about this morning, it is very important for us not to forget the federal government's obligation and responsibility to clean up the legacy of those efforts and I am pleased to hear your comments along those lines earlier in your statement.

But having said that, I am concerned about the potential impacts of the Administration's proposed \$100 million cut to the Richland Operations Office, particularly on cleanup work along the river corridor. Delays to this work—and I have seen this firsthand—would result in a higher total project cost, missed milestones, and loss of cleanup momentum.

The budget, I believe, cites technical reasons for the delays to the Columbia River Corridor cleanup. Could you explain those technical reasons why work can't continue, particularly at the 324 Building, as well as at the 618-10 site, and barring any technical reasons, is the Department of Energy committed to continuing this work in fiscal year 2015 with funding appropriated for this purpose and in fiscal year 2016 in order to meet existing legal milestones along the river corridor?

Secretary MONIZ. So, first of all, let me just say that in Hanford, with the Tri-Cities, it really is a very important and has been a very important community for the Department of Energy for a long time and it is our responsibility to respond to the cleanup challenge. I might add to that as an aside and also to the science opportunities, for example, like the Pacific Northwest laboratory, which today is celebrating its 50th anniversary. Maybe you will be there at the celebration.

Mr. NEWHOUSE. I hope to see you there.

Secretary MONIZ. Okay. I will see you there.

So going back to the cleanup, as you well know—and I do want to start out by emphasizing that, you know, within a pretty constrained budget the overall site budget will be going up \$100 million in our proposal as we advance with the WTP project where our aim is to be able to start vitrifying at least the low-activity waste very early in the next decade like 2021, 2022.

In terms of the Richland budget, first of all, again, as you know, we have made very substantial progress on the river corridor cleanup and in fact are providing now access to a substantial part of that corridor. Secondly, with the Richland budget, we will certainly be continuing aggressively with things like the groundwater pumping and, you know, chromium treatment, et cetera. We also are making tremendous progress. For example, it wasn't long ago that the highest risk facility was viewed as the plutonium finishing plant and we are getting that down to grade. So I think overall the site will have an increased budget and I think we will make very, very creditable progress in both parts of the program.

Mr. NEWHOUSE. So that gives me a good segue into my next question, the WTP, the vitrification plant. Certainly, the intention is for that classified waste to go to a repository, permanent repository. Yucca Mountain has been in sights for many years. Could you tell me the scientific reasoning why Hanford's waste cannot go to Yucca Mountain? And if so, how does the Administration's budget request propose to deal with the waste and by what deadline?

Secretary MONIZ. Well, that is actually a very interesting question for a reason I will come to. First of all, scientifically there has long been the statement that civilian-spent fuel and high-level waste such as that from Hanford can certainly go to the same geological repository. That has been the assumption all along and we are working on three different geologies for geological repository within the framework, as I said earlier, but we just don't think the Yucca Mountain is a workable solution. We just need to have a consent-based approach. So we are working on that.

But let me note as well something that has not been reached for a full decision yet and that is that at the recommendation of the Blue Ribbon Commission, the Department carried out and we have posted on our website back in October/November a technical report on the issue of whether the high-level defense waste should be treated separately from commercial spent fuel. There are a variety of reasons for that. The report details them. Among them is the fact that the high-level waste has many, many different forms and might have specialized approaches.

One which is in our fiscal year 2016 budget is to advance not with nuclear waste yet but to advance what is called a deep borehole demonstration project. That ultimately could be very interesting for Hanford because about 1/3 of the activity at the site are cesium and strontium capsules, which are very small in diameter and could be very well suited perhaps for much earlier disposal through a borehole approach. I don't know. We have to drill—we have to do the demonstration project, do the science, which is what we want to do in 2016. So that is another interesting direction which could be very material for Hanford. I would be—we would be happy to discuss them or with you if you would like.

Mr. NEWHOUSE. Thank you. I have got more questions but thank you, Mr. Chairman. I have gone over my time.

Chairman SMITH. Thank you, Mr. Newhouse.

The gentleman from Virginia Mr. Beyer is recognized.

Mr. BEYER. Thank you, Mr. Chairman.

And, Mr. Secretary, I have three questions for you.

First, I am very impressed by your Ph.D. in theoretical physics from Stanford. You are my hero.

Secretary MONIZ. I used to be a practicing physicist.

Mr. BEYER. But in the budget request the Fusion Energy Program is the only Office of Science program that really gets a cut. And I understand part of this is the closeout of the Alcator C-Mod program at MIT, but if fusion is still the Holy Grail for economic growth, for climate, minimal impact and the like, why cut now?

Secretary MONIZ. Sir, that is the one area from which I am recused. However, my colleague Under Secretary Orr is prepared to answer that question.

Mr. ORR. So the fusion research program of course continues to be an important one for us. It is a long-term program. It is one that requires us to understand the science of dense plasmas of materials that can lead eventually to fusion. It is a tough enough problem that a measured approach is appropriate for that. We have a domestic program that involves now three facilities, Princeton, one in San Diego, and the facility that is just finishing up at MIT. And it also includes an international component, the international reac-

tor ITER in France. And so the budget that you have proposed for this year is balanced across those commitments.

Mr. BEYER. Great. Thank you very much.

Mr. Secretary, when the EPA rolled out the new power plant limits, it cited carbon capture to storage as the best system for emissions reductions for the coal-fired power plants. I want to point out in the budget that we have presented that you have a 32.5 percent increase in the budget for carbon capture, 8.8 percent increase for carbon storage, 93 percent increase for crosscutting supercritical CO₂ technologies, so it seems to me that this is not a war on coal but rather a very significant commitment to clean coal.

Secretary MONIZ. Absolutely. And basically we have a multipronged approach for having coal be a significant contributor, even in a low-carbon world.

Mr. BEYER. Also I would like to point out that in the reading it pointed out that FutureGen is shutting down because the \$500 million in private-sector money that was supposed to come didn't—never materialized unlike so many of the other renewable technologies where the private-sector money has come forward. But what is next for us with CCS?

Secretary MONIZ. Well, first of all, we will be coming online with additional projects. For example, we have broken ground in Texas on the PetroNova project. For example, we are already sequestering carbon in Texas for a refinery operation, for example, a cement operation. We will be seeing an ethanol plant CCS project starting up in Illinois with the deep saline aquifer.

Oh, and by the way, I should really mention as well across the border in Canada the Boundary Dam project is functioning with coal and post-combustion capture.

Another thing we often forget about, by the way—this is not in the future but if I may go to the past because we forget—in North Dakota there is the Great Plains gasification plant that has been gasifying coal lignite for a long time. It is kind of not told a lot but they have sent 20 megatons of CO₂ across the border to Canada for use in enhanced oil recovery. So there is a lot going on, there is going to be a lot more going on in demonstration project but also in some basic research to look for breakthrough carbon capture technologies that can lower costs.

Mr. BEYER. Let me ask you one more question, please.

My friends in the energy field have been telling me for years that the great challenge is storage. You have the power plants, for example, come online in big step increments and offline that way rather than smoothly and efficiently. If there is only \$21 million in the budget for energy storage, which in the \$29.9 billion budget is 6/100ths of one percent or 1 in every \$1,500, why not more for storage?

Secretary MONIZ. Well, I think I will not be able to give you a total, a sum here but we will get back to you with it. But the point is storage, battery technologies, microhydro pump storage, there is storage distributed around many, many parts of the budget, so it may not be quite as apparent and maybe we should do a—maybe we should do actually a little table of that that brings together all those pieces. But in fact we are increasing our emphasis on storage

both utility-scale storage to things like, in our hydro budget, an increase for microhydro pump storage.

Today, by far the biggest energy storage in our grid is pump storage and it is big. But it is big only in very select locations where you have the right opportunity. So things like micropump storage could be much more ubiquitous. That is just one example in addition to the battery work that is going on.

I might say on battery work also, especially if I go to automotive batteries, the cost reductions there again have been very, very impressive. We are now at the place where, with mass production of today's technologies, we are below \$300 a kilowatt hour. We were at 600 not long ago. Our goal remains \$125 by the end of the decade. We have got to push but it is a big drop.

Mr. BEYER. Thank you, Mr. Secretary.

Chairman SMITH. Thank you, Mr. Beyer.

Mr. BEYER. Thank you, Mr. Chairman

Chairman SMITH. The gentleman from Kentucky, Mr. Massie, is recognized for his questions.

Mr. MASSIE. Secretary Moniz, in this Committee we often discuss how to leverage the DOE and the labs there to accelerate technological development both for private companies and for the good of society. In one area of technology we have seen some stagnation and that is in nuclear energy. We are sort of stuck in one reactor design right now. Is there a way that you could use the labs at the DOE to allow these new types of reactors, at least prototypes of them, to be built? Because right now they have to go through a licensing process that sort of crimps the line. The venture capitalists don't want to invest in something that is going to take a ten-year licensing process. Is there a way that we could use the labs that you have to authorize, host, and oversee privately funded prototype reactors?

Secretary MONIZ. Well, I would say in my view not really. There is discussion, for example, of using, say, small modular reactors deployed at DOE sites or government sites like the TVA, for example, Idaho, other places. But frankly, at least my view is that we really need NRC licensing to have the confidence of the public in terms of the safety of these reactors, and I would love to discuss this longer. You put your finger on a very important issue. The entire experience base really of the NRC has been in light water reactor technology. It is one reason why the initial small modular reactors being advanced are light water reactor technologies. And the question is how do we get beyond that to molten salt reactors, fast reactors, et cetera? And I think the only way in the end is to make investments I think through the appropriations process for having NRC now be able to build up an experience base for alternative technologies because it is kind of a chicken-and-egg problem otherwise.

Mr. MASSIE. We are stuck where we are and I am afraid that the—

Secretary MONIZ. Yeah.

Mr. MASSIE. —other countries are going to leap-frog us in this if we don't figure out a way to solve that chicken-and-egg problem.

Secretary MONIZ. And we are seeing a little bit of that already.

Mr. MASSIE. Yeah, unfortunately.

Secretary MONIZ. Yeah.

Mr. MASSIE. You mentioned that 20 megatons of CO₂ had been transferred to Canada to extract oil. Was that in a pipeline?

Secretary MONIZ. Yes.

Mr. MASSIE. So we will need more of these pipelines if we use CO₂ and transfer it for other projects?

Secretary MONIZ. Yeah. We actually have—I forget the exact number—we may have like 1,000 miles of CO₂ pipeline already. That is mostly to transport natural CO₂ to enhanced oil recovery sites. We are actually using now about 60 megatons of CO₂ per year for enhanced oil recovery.

Mr. MASSIE. Are you worried that we will have as much trouble from this Administration in getting pipelines for CO₂ as we have for tar sands?

Secretary MONIZ. The CO₂ pipelines typically right now are pretty reasonably short runs. For example, the Kemper project in Mississippi built a 60-mile CO₂ pipeline for EOR.

Mr. MASSIE. So you are not advocating—

Secretary MONIZ. Texas has a lot of CO₂ pipelines.

Mr. MASSIE. So you think it would be fairly easy to get these approved?

Secretary MONIZ. I would never say anything is fairly easy but—

Mr. MASSIE. Okay. Well, I hope it—

Secretary MONIZ. —they are typically not—they are certainly not international issues.

Mr. MASSIE. Right.

Secretary MONIZ. May I, if I can just say—

Mr. MASSIE. Didn't the CO₂ go from the United States—

Secretary MONIZ. —for the future—

Mr. MASSIE. —to Canada?

Secretary MONIZ. Say that again.

Mr. MASSIE. The CO₂ that you talked about, the 20 megatons, did it go from the United States to Canada?

Secretary MONIZ. Yeah, from North Dakota to Canada.

Mr. MASSIE. Is that not an international pipeline?

Secretary MONIZ. That is. I am saying for—

Mr. MASSIE. Okay. All right.

Secretary MONIZ. —future build-out—

Mr. MASSIE. I answered the question for you then.

Secretary MONIZ. Future build-out is a different issue.

Mr. MASSIE. So is it true that a plant that uses carbon capture, fossil fuel plant that uses carbon capture versus one that doesn't has to consume more fuel per kilowatt hour?

Secretary MONIZ. Well, if you—certainly if you look at post-combustion capture, obviously it is always cheaper to not capture.

Mr. MASSIE. But it is going to consume—

Secretary MONIZ. But—

Mr. MASSIE. —more fossil fuels—

Secretary MONIZ. Well, yes, so not—

Mr. MASSIE. —if you capture, correct?

Secretary MONIZ. So you can do it either way, yes. Yes.

Mr. MASSIE. Okay. So how much more will it cost to run one of these and what will that do to the price of electricity for consumers since it is going to consume—

Secretary MONIZ. The—

Mr. MASSIE. You concede it consumes more fuel to run it.

Secretary MONIZ. Yes, but the—

Mr. MASSIE. So it is less efficient?

Secretary MONIZ. If you use the plant's energy to do the capture, then it will be less efficient; that is clear, right?

Mr. MASSIE. All the designs that I have seen, I mean unless there is a free source of energy, it is going to consume energy—

Secretary MONIZ. Well, no—

Mr. MASSIE. —and cost more, correct? Does it cost more? Can you give me a yes-or-no answer?

Secretary MONIZ. Let me—I am sorry. I have to—if you are talking about post-combustion capture, that logic is clear.

Mr. MASSIE. Okay.

Secretary MONIZ. If you go to a different technology like gasification, it could be a different issue in principle, not in practice today but in principle. So clearly capturing carbon is more expensive than not capturing carbon in a post-combustion world, but the comparison is that cost, let's say, in a low-carbon world compared to other low-carbon technologies. And as I said earlier, if you look at the proposed 111(b) rule, it only requires, if you build an efficient plant, ultra-supercritical, it is only a 30 percent capture.

Mr. MASSIE. For the record, my question was how much more expensive is it to run one of these theoretical carbon capture plants compared to today's existing science—

Secretary MONIZ. With a—

Mr. MASSIE. —and what is the effect on consumer price of electricity?

Secretary MONIZ. With a 30 percent capture it is—I don't know the exact dollar; I will get back to you—but it is probably couple cents.

Mr. MASSIE. Per kilowatt hour?

Secretary MONIZ. Per kilowatt hour.

Mr. MASSIE. With—so—

Secretary MONIZ. But that is to be compared with alternative technologies, and so, you know—I mean I think that is the comparison you have to make.

Mr. MASSIE. So a couple cents is like at least 30 percent more.

Secretary MONIZ. Well, no, the average retail price is about 11 cents—

Mr. MASSIE. Okay, 20 percent.

Secretary MONIZ. —in the United States.

Mr. MASSIE. Thank you. I yield back. Right.

Chairman SMITH. Thank you, Mr. Massie.

The gentleman from Colorado, Mr. Perlmutter, is recognized for his questions.

Mr. PERLMUTTER. Thank you, Mr. Chairman.

Mr. Grayson, I appreciate the opportunity to serve on this Committee so thank you very much.

Mr. Secretary, good to see you.

I am running between two committee hearings. The other committee hearing is with Chairwoman Janet Yellen on the Humphrey-Hawkins, you know, “what is happening in the economy” kind of discussion with her, and she starts off with this year’s monetary report so I am going to come at it from an economic perspective. You have been getting lots of science questions and kilowatt hour questions.

I want to start with something where Mr. Westerman was asking you, about the decline in the price of oil and its effect as you see it as the Secretary of the Energy Department on your overall kind of portfolio, renewables, efficiency, fossil fuels, nuclear, et cetera. We saw in the ’80s—and I will just tee it up this way—we saw in the ’80s when the Saudis dropped it from \$30 to \$10, really a decimation of the energy sector, renewables and fossil fuels particularly for about 15 or 20 years.

We have now gone from \$107 down to about \$50 for a variety of reasons. And you may expand on those, you know, more production, less use, whatever, how do you see that playing out in terms of the economy? Because in Colorado in the ’80s and the early ’90s when that happened, it hurt us pretty good, both starting with the energy sector and then it flowed out to retail, real estate, banking.

And so I am just going to throw that to you, sir, and ask for your—you know, your thoughts.

Secretary MONIZ. Well, first of all, we always start with the point that overall it is very good for the overall national economy, for consumers. Indeed, EIA projects just the lower gasoline prices as translating to about \$750 per year for the average household. So we have that.

Now, clearly, when we go to the producing areas, there is obviously lower prices. The—nevertheless, the EIA does project higher production in 2015 than in 2014, but the amount of increase is projected to be, you know, dampened clearly. And if the prices were to stay, you know, in the 40s, then presumably in 2016 one might see some little—some roll-off, although even then the EIA does not project, you know, major roll-off.

We also know that the prices tend to be somewhat volatile and at the Department of Energy—to go to that part of the question, the Department of Energy, it frankly does not change our R&D portfolio. Our job is to enable the whole range of energy options to be developed to drive costs down so that the marketplace in five years, in ten years, in twenty years, in thirty years will have a set of options.

Mr. PERLMUTTER. All right. So following up on that, what have you seen in terms of the cost of wind energy, solar energy, whatever other kinds of renewables, alternatives in terms of their ability just again within the market to withstand this kind of a drop or to provide energy sources at competitive rates compared to fossil fuels with this price drop?

Secretary MONIZ. Well, certainly if you take solar, we have seen no real drop in the deployment at this stage. There may be issues down the road with, you know, tax credits issues, how taxes are handled, but so far the cost reduction of solar has been so dramatic that we are seeing just substantial—very, very substantial deployment.

I was saying earlier that the cost of a solar module is now significantly lower than a dollar a watt and I expect that we will reach the Holy Grail of 50 cents a watt within 2, 3 years.

Mr. PERLMUTTER. What about wind?

Secretary MONIZ. Wind has also come down dramatically. Mainly the issue of—you know, we are getting larger turbines, the longer blades, much more efficient in terms of capturing the wind resource. And of course we are working—in terms of the R&D side, our D&D, we are also now pushing hard into areas like offshore wind where the resource is dramatic. And then there are very substantial—I mean like ARPA-E is also supported and it has now gone out to Google, you know, tethered wind—

Mr. PERLMUTTER. Right.

Secretary MONIZ. —kites and this kind of a thing. So there are some pretty interesting, novel concepts but just taking land-based wind, cost reduction has clearly put wind into a very competitive range, you know, for good wind sites.

Mr. PERLMUTTER. Okay. Thank you.

Thank you, Mr. Chairman. I yield back.

Mr. WEBER. [Presiding] okay. The gentleman yields back.

The gentleman from Illinois, Mr. Hultgren.

Mr. HULTGREN. Thank you, Chairman.

Thank you, Mr. Secretary. Always good to have you here to discuss the important work of the Department of Energy, so thank you for your work.

I also had a very good meeting a couple of weeks ago with Under Secretary Orr. We had a very good discussion. As you probably guessed, we did talk about DOE's commitment to P5 as it relates to Fermilab in my district. I do think we are in a position as a nation to take a leadership role on an international facility, and I really do hope to see that happen.

Government-wide I am glad the President's budget does increase R&D but I still see it as a problem that has been ongoing with this Administration's choice to value applied R&D over basic scientific research. Why does the President's budget propose a five percent increase to applied R&D while only giving a 3.5 percent increase to basic research?

Secretary MONIZ. Well, as I said earlier, in terms of the Office of Science budget, because the Office of Science has done a very good job in terms of how it stages its major facilities in particular, and so if you look at the budget request, we continue to have robust development of new capabilities, we support the Long-Baseline Neutrino facility at Fermilab, and the budget also proposes like a 98 percent full operation budget of our facilities. So we think it is going to be a very, very strong budget and certainly support the national user community quite well.

Mr. HULTGREN. Again, my concern is—I am grateful that R&D is increasing but I still feel like there is misapplied priorities where we are pushing applied research more than basic research at a time where budgets are still difficult. And so to me that just gets back to a fundamental concern.

Let me get on to something else because I want to cover a couple different questions. What more can DOE do to be making it easier to transition technology out of the labs? Now that Ellen Williams

is confirmed at ARPA-E, can you tell how you intend to use the new Office of Technology Transitions?

Secretary MONIZ. Thank you, and thank you for your interest and leadership in that area.

So as you said, Ellen Williams has now taken up the ARPA-E reins but she has left us with a great plan which we are implementing, so we have established the Office of Technology Transitions. A very capable person, Jetta Wong, who has run that kind of a program in EERE is at least our acting director of that office and Technology Transfer Coordinator. But also very importantly we have followed now I would say the letter of the 2005 directive to establish a Technology Commercialization Fund. So we will be in fiscal year 2016 taking 0.9 percent of the applied energy R&D budget into a technology—Energy Technology Commercialization Fund that will be operated by the Office of Technology Transitions as a cost-shared competitive program for labs and companies to transition technologies.

Mr. HULTGREN. Okay. Thank you.

Let me switch topics in my last minute-and-a-half or so that I have got. I would like to discuss, as many others have, nuclear power, which certainly is important to my State. Illinois is the nation's largest producer of nuclear energy. Do you recognize the need to keep the existing fleet competitive?

Secretary MONIZ. Yes, I am very concerned about that and in particular in the context of low carbon.

Mr. HULTGREN. Let me put out some questions and then if you can respond to any of these that you are able to in time. Why then has the Administration requested a nuclear tax via the Uranium Enrichment Decontamination and Decommissioning Fund? Has the fund been exhausted? How much remains in that fund? And why are you requesting this tax now given the amount of plants currently at risk? And finally, how does the Administration expect the United States to meet international climate goals if our nuclear fleets continue to face early retirements?

Secretary MONIZ. A lot of questions.

Mr. HULTGREN. A lot there, I know.

Secretary MONIZ. I think the UED&D fund, I am not entirely sure but I think there is something like 3 or \$4 billion I think in that fund. I can check that—

Mr. HULTGREN. That would be great—

Secretary MONIZ. —precisely—

Mr. HULTGREN. —if you can let us know, and maybe if we could follow up with—

Secretary MONIZ. And—

Mr. HULTGREN. —questions on this.

Secretary MONIZ. Okay. All right. Fine.

Mr. HULTGREN. Let me just ask you real quick, as far as nuclear fleets continue to face early retirement, is that a concern of yours? How does that—how do we mix these I think competing facts?

Secretary MONIZ. Yes. In fact I have convened brainstorming sessions on this issue of current nuclear fleet retirements. One of the issues is it turns out we don't—at the federal level we don't have a lot of levers there so we are convening discussions. The—in fact, in Illinois, as you know very well, there is very active consideration

at the state level as to how one can value what I would say is the diversification of supply and the baseload nature, the capacity value of nuclear plants. But, again, it is really at the state level as opposed to federal.

Mr. HULTGREN. Again, my time is up. Thank you for being here. Thank you again for your voiced support of LBNE and the work that is going on there. I think it is so important for us and really a chance for us to lead again on an important project in the world, so thank you for your help on that.

Secretary MONIZ. And if I may add an anecdote that when I visited Fermilab a few months back, I was very pleased to have a researcher ask me to sign a paper I wrote in 1971—

Mr. HULTGREN. Wow.

Secretary MONIZ. —because they were using it in the analysis so—

Mr. HULTGREN. Very good.

Secretary MONIZ. —it was a great trip.

Mr. HULTGREN. Good, good. That is great. Thank you.

Mr. WEBER. The gentleman from Illinois yields back. Now another one of Illinois' fine gentlemen is recognized, Mr. Lipinski.

Mr. LIPINSKI. Thank you, Mr. Chairman.

I want to welcome back Secretary Moniz. It is good to see you again.

Secretary MONIZ. Good to see you.

Mr. LIPINSKI. I always learn a tremendous amount when I talk to you and when you testify, so it is good to have you here.

As you and this Committee know, improving technology transfer has been one of my top priorities in Congress, so I want to applaud you and the Department for some of the things you have done recently to improve the commercialization potential for DOE-funded research at our universities and national labs.

First is the Office of Technology Transitions, which Mr. Hultgren just mentioned you had talked about, which was announced two weeks ago to fulfill Congressional requirements for a Technology Commercialization Fund. As you know, it has been a big interest of mine and it was one of the first matters we spoke about when we met in July of 2013, and I appreciated working with you and your staff to make this happen.

Secretary MONIZ. And again, I would like to add to you as well my thanks for your leadership and interest in this issue. You have obviously been very, very dedicated to it.

Mr. LIPINSKI. Thank you. And the second item is the pilot for the Lab-Corp program based on NSF's Innovation Corps, also known as the I-Corps program. For labs like Argonne in my district with a good deal of use-inspired basic research such as the JCESR, initiatives on battery research, I think a program like Lab-Corp can really help by teaching researchers more about how the commercialization process works so that they can more easily identify what basic research problems need to be solved to build better batteries. And as you have talked about how important that that is.

And one other thing that you had mentioned I want to thank you for is moving forward on the H-Prize for the competition on fueling infrastructure for hydrogen as a transportation fuel. The H-Prize Act was—I believe it was the first bill that I got signed into law.

It was about seven years ago, and I am happy that the Department is now using the H-Prize to help move us to a clean energy future. So I thank you for moving forward with that.

So with all that out of the way I want to ask a couple questions on—in the time I have left on these three things that I have brought up. First on Lab-Corp, what do you see as the potential value of the program given that it is a pilot and what are you going to be looking for in terms of impacts when evaluating the effectiveness of the program at the labs?

Secretary MONIZ. Well, once again, thank you for your interest and leadership in this area.

So the LabCorp, as you said, the pilot, I think it is a \$2.5 million pilot as I recall modeled after the I-Corps. We have NREL as our coordinator and Argonne, Idaho, Pacific Northwest, Berkeley, and Livermore engaged. I believe this summer 15 teams will go through the LabCorp training program and the issue then is we will have to go back probably in a couple of years to see if the outcome is there that this cadre of researchers has in fact been able to pick up the game in terms of tech transfer. That is the outcome we are looking for.

Mr. LIPINSKI. All right. On the Office of Technology Transitions and the Tech Commercialization Fund, what types of opportunities will the Office be looking to support and will they potentially include support for technology maturation activities at the labs?

Secretary MONIZ. Yes, I think, you know, to be honest, the real program design still needs more development and we would be happy to work with you on that, but technology maturation is clearly important. We are looking for partnerships of the labs with industry, with the private sector to be able to mature and move out technologies. But again, to be honest, we still have some real program design to do there.

Mr. LIPINSKI. Very well. I look forward to working with you—

Secretary MONIZ. Great.

Mr. LIPINSKI. —on that. And the final one is I had mentioned the H-Prize and the competition now that the Department is working on. Could you tell me anything about where this is right—where exactly this is right now?

Secretary MONIZ. You know, other than our moving out on it, I really would have to get back to you following the hearing in terms of exact status. I just don't know that right now.

Mr. LIPINSKI. Okay. Well, we will follow up on that on—

Secretary MONIZ. Thank you.

Mr. LIPINSKI. —that one then.

Secretary MONIZ. Thank you.

Mr. LIPINSKI. So I thank you very much again for all your—the work that you have done and I think we are making great progress despite the—you know, the difficult budgetary times that we are in, so I thank you for—

Secretary MONIZ. Thank you.

Mr. LIPINSKI. —what you do and I yield back.

Mr. WEBER. Thank you.

The gentleman from Alabama, Mr. Palmer, is recognized.

Mr. PALMER. Thank you, Mr. Chairman.

Mr. Secretary, the research that you are doing on hydraulic fracking right now seems to be focused on the impact on water quality. Is the Department of Energy doing any research on improving fracking in the terms of making it more and more economically viable? As the price of oil has come down, obviously it gets to a price point where it is not viable. Is DOE trying to do anything to make it more economically viable?

Secretary MONIZ. Again, I will get back to you in detail but my understanding at the moment is that we are not, that that is principally in the private sector, and what we are looking at is mostly the minimization of environmental footprint. But of course that in turn would have—

Mr. PALMER. But wait—

Secretary MONIZ. —economic consequences.

Mr. PALMER. Wait on that. You are investing enormous amounts of money in trying to make renewable energy economically viable. You are the Department of Energy; you are not the EPA, so it would make sense to me that through the Department of Energy we would want to have maximum access to our energy resources because it helps our economy and improves our national security. So why wouldn't the Department of Energy be investing in supporting additional research and making fracking more economically viable?

Secretary MONIZ. Well, again, I will look into that in detail but, you know, as we said earlier, the—I mean the Department has certainly over these last decades contributed substantially to developing the technology and now one has, you know, very large companies who are investing in that research. We wanted to add value with the government funding. So our—my view at least is right now focusing mainly on things like, for example, reuse of water that—

Mr. PALMER. Well, let me—I want to stay on—

Secretary MONIZ. —it is all very important.

Mr. PALMER. —this—

Secretary MONIZ. Okay.

Mr. PALMER. —theme a little bit. Have we returned to the pre-BP spill levels for permitting in the Gulf Coast for oil exploration and extraction? Do you—

Secretary MONIZ. I don't know that. That is a Department of Interior issue and I just don't know that directly.

Mr. PALMER. Okay. The Department of Energy doesn't do the permitting?

Secretary MONIZ. No, we do not. No.

Mr. PALMER. Okay. Well, I will just say for the record that if we got back to the permitting level, it would add 190,000 jobs if we cleared the backlog that existed at the time of the Deepwater Horizon. That would add another 400,000 and about \$45 billion to our gross domestic product.

I want to switch to something else. There was an article in the L.A. Times back in December 2013, about 14 months ago, a little over 14 months ago that talked about our power grid and the fact that it is not designed for renewables, and that to get it up to grade by 2030 is going to cost us about a trillion dollars. Has the Depart-

ment of Energy taken that into account in the headlong push toward renewables?

Secretary MONIZ. Yes, indeed. We have a very, very large focus on the whole question of renewables integration. It is part of our grid modernization project. We will be saying more about that in our upcoming Quadrennial Energy Review probably in a few weeks, I hope at least in a few weeks. And I would also say that I am—I would perhaps question that—the scale of that resource.

Mr. PALMER. Well, it came out of Caltech. I think they are a fairly reputable source.

But the other thing is the fact that with renewables you don't have consistent energy output. If the wind—right now we are having to dump power because we don't have viable storage options and there is a huge debate over whether or not we can make that economically viable. But I want to ask you something else in the last few seconds that I have, and it appears that we plan to have 80 percent of our power, our energy resources coming from renewables within the next two or three decades. Does the Department of Energy have any plans for the fossil fuels resources that we have that I think represent an enormous economic resource for the country in terms of oil, natural gas, and coal?

Secretary MONIZ. Well, certainly in terms of the power sector where oil does not play such a major role of course in the United States, but in terms of the power sector, all of these multibillion dollar investments and now proposed tax credits for coal very much for having coal—continue to have a major presence even with low carbon. Natural gas we see as a very important bridge to low carbon, and in fiscal year 2016 we are proposing to start carbon capture with gas as well. And then of course the nuclear renewables and efficiency. Efficiency of course is generally speaking also a fossil program if you like. It is about efficient use of fossil fuels.

Mr. PALMER. Thank you, Mr. Chairman.

Mr. WEBER. The gentleman yields back.

And the gentleman from California Dr. Bera is recognized.

Mr. BERA. Great. Thank you, Secretary, for being here. Thank you to the Chairman and Ranking Member.

I want to shift a little bit to the Department's collaboration with higher education, some of the funding research particularly in the area of ARPA-E as well. You know, my home institution is University of California Davis. It does a lot with the Department in the renewable space and recently has received some awards as well. I am just curious about the different details and the different roles that ARPA-E is playing in terms of collaboration with our institutions of higher education, some of the projects that you are working on.

Secretary MONIZ. Well, ARPA-E certainly makes awards to universities, to our labs, and to industry, so it is complete spectrum. It is not—

Mr. BERA. Right.

Secretary MONIZ. —only one or the other. In terms of specifics, well, if I go back to my previous life in particular, there have been strong projects in things like novel storage technologies. One of the very first round of awards, for example, was for something called liquid metal batteries that are now actually getting into the mar-

ketplace. That is an example. I mean there are so many diverse areas. For example, going back to the question earlier, high-strength ways of storing hydrogen, for example, with advanced materials research. That is an example. We could go on and on with different technologies.

Mr. BERA. And, Secretary, in your experience when we make these investments in R&D and in advanced research, there is a return on that investment in terms of the new industries that are spawned and so forth. Is that—

Secretary MONIZ. Major amplification, yeah.

Mr. BERA. Yeah. Absolutely. So in many ways when we look at our economic strength over the past decades and so forth and what puts us in—is this investment in innovation and this investment in, you know, challenging some of the issues that lay ahead of us, maybe not knowing how we are going to address, let's say, you know, carbon sequestration that is already in the atmosphere. We may not know how we were going to degrade that carbon, yet we do know part of the challenge is certainly capturing carbon that is being emitted today but we also—you know, I think when you were here last session of Congress talked about the enormous amount of carbon that is already trapped in our atmosphere and, you know, I would be curious if the Department is looking at and funding some of those technologies that—or some of the research that would help us think about how we degrade the carbon that is already there.

Secretary MONIZ. Yes, well, there is work on that. The—of course today this issue of getting carbon directly out of the atmosphere is very expensive and there is a long, long way to go before having that be scalable. And, by the way, success there still then leaves you with of course the big sequestration issue if you get all of that carbon out of the atmosphere. So that is more in the long-term. I would say we do have a much stronger emphasis today on this question of capturing current anthropogenic emissions, especially from large point sources.

Mr. BERA. So the focus is actually capturing it at the source right now—

Secretary MONIZ. Correct, because—

Mr. BERA. —and then long-term—

Secretary MONIZ. —that is where the lower cost opportunities are for the near future.

Mr. BERA. And I would certainly like us to know and start funding the research thinking about the longer-term sequestration issues.

Secretary MONIZ. Well, we have a lot of projects and sometimes what is called artificial photosynthesis—

Mr. BERA. Okay.

Secretary MONIZ. A Holy Grail would be to combine CO₂ out of the atmosphere, water, and light and produce a liquid fuel. So we have work ongoing on that.

Mr. BERA. Absolutely. And again, understanding that right now it is not at scale because of the massive amounts of carbon that are there—

Secretary MONIZ. Right.

Mr. BERA. —but, you know, that has never stopped us as Americans. I mean we understand that we may not know how to do it at a cost and price point today that allows us to do it, but again, if we challenge ourselves, if we use our innovation, you know, a decade from now, you know, you might have——

Secretary MONIZ. We have——

Mr. BERA. —that breakthrough technology.

Secretary MONIZ. I completely agree. We have no bigger edge than our research——

Mr. BERA. Absolutely.

Secretary MONIZ. —and innovation enterprise.

Mr. BERA. Well, and let's certainly take advantage of that.

Just following up on some of the questions that Mr. Lipinski had asked, my colleague from Illinois, on the Office of Technology Transfer and so forth, certainly an area that I am interested in, you know, particularly within our public universities, and recognizing that we have limited research dollars. You know, there is certainly the private sector institutions that want to partner with our academic universities. You know, I would be curious on an update some of the issues that this body—you would like us to focus on particularly in the space of technology transfer.

Secretary MONIZ. Well, the—first of all I might say historically that Congress played an enormous role in kick-starting this. Going back to Bayh-Dole, for example, absolutely central legislation to do this. And I might say in my view I see universities, because of the whole changing innovation system being if anything closer to the marketplace now, the value system I think has evolved to value those kinds of activities.

So anyway—so I think we need to keep working together in terms of legislative approaches, incentives in some of our programs, DOE for sure but also NSF and NIH, and I think we are seeing a very interesting development in terms of being closer to the marketplace.

Mr. BERA. Absolutely. Well, and again, you can count on this office if there are things that we can do in Congress to set that framework——

Secretary MONIZ. Great.

Mr. BERA. —for a closer public-private partnership, that would be great. Thank you.

Secretary MONIZ. I appreciate that. Thank you.

Mr. WEBER. Secretary Moniz, we thank you for your testimony and we thank the Members for their questions. The record will remain open for two weeks for additional comments and written questions from Members.

Does the gentleman from Oklahoma have any questions?

Mr. LUCAS. No, sir. I just appreciate your magnificent chairmanship, sir.

Mr. WEBER. All right. Well, that——

Mr. HULTGREN. So say we all.

Mr. WEBER. —particularly will be recorded in the—without objection.

Dr. Moniz, thank you.

Secretary MONIZ. Thank you, sir.

Mr. WEBER. This hearing is adjourned.

Secretary MONIZ. Thank you.
[Whereupon, at 12:15 p.m., the Committee was adjourned.]

Appendix I

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Responses by The Honorable Ernest Moniz

QUESTIONS FROM CHAIRMAN LAMAR SMITH

- Q1. The multi-year trend in Congressional appropriations is far more modest than the budget proposed by the White House, providing little-to-no growth in the budget for science and energy research. If these budgets remain flat in FY 2016 appropriations, how will you adjust this budget proposal to meet enacted levels?
- A1. The President's FY 2016 Budget requests an appropriate level of funding for science and energy research to ensure the Nation's continued domestic energy security, sustain our international competitiveness in the clean energy marketplace, and develop innovative technologies to mitigate greenhouse gas emissions and the harmful effects of climate change. A successful all-of-the-above energy strategy requires strong investment in clean fossil, nuclear and renewable energy technologies, as well as energy efficiency, sustainable transportation, advanced manufacturing and modernization of the electric grid. Underpinning these applied technology investments is funding for critical basic research and world-leading facilities that support over 30,000 scientists each year focused on discovery science. Strong support for our basic and applied research portfolio at the requested levels will maintain the Nation's leadership on the cutting edge of science and energy technology in an era of ever-increasing international competition. The Department always leverages and optimizes its available funding to make most effective use of the taxpayer dollars with which it is entrusted, but flat funding or funding below the requested levels will detrimentally impact our Nation's ability to compete on the global stage in the new clean energy economy.
- Q2. Earlier this year, the House passed HR 35 – the Low Dose Radiation Research Act of 2015, which intends to establish a research plan to more accurately ascertain whether there are health risks associated with low dose radiation. In this year's budget request, you propose to cut radiological sciences research by over \$3 million and eventually close out this work. Can you explain why DOE is not prioritizing research that could provide immense value to physicians, workers at industrial sites, and emergency planners?
- A2. Over the past 17 years, the Department of Energy (DOE) low dose radiation research program has produced new knowledge on how cells respond to radiation. For example, the program has been instrumental in discovering DNA repair mechanisms as part of an adaptive response of cells to radiation exposure and bystander effects on neighboring cells exposed to radiation. Some of these molecular-level observations support the idea

of a threshold level for radiation dose and all of the information from this research has been made available to the scientific community and the Federal and state regulatory agencies that have direct responsibility for assessing the human health effects of radiation exposure. However, these observations, while scientifically significant, have not extrapolated to effects on cancer risks in humans and therefore have not had any impact on radiation protection standards thus far.

As such, the Department's Office of Science is prioritizing its efforts toward the basic science challenges needed to advance the Administration's emphasis on sustainable bioenergy development.

The National Academies are in the preliminary planning stages for their Biologic Effects of Ionizing Radiation VIII study. DOE looks forward to participating with the Academies on its study, and hopes that DOE's research to date on this topic is factored in as the Academies outline the state of the science, make recommendations for additional research, and identify potential updates to the regulatory framework for human radiation protection standards.

- Q3a. The Department's FY 2016 budget requests includes increased spending for the Office of Energy Efficiency and Renewable Energy—from 1.9 billion in FY 2015 to over 2.7 billion for FY 2016—a 42% increase.

What steps have been taken to ensure the Office of Energy Efficiency and Renewable Energy (EERE) is capable of effectively and responsibly managing such a large increase in funds should Congress accept the President's FY 2016 budget request?

- A3a. In order to be an effective steward of taxpayer dollars and produce the highest impact from its investments, EERE has implemented "Active Project Management" approaches—inspired by the Advanced Research Projects Agency–Energy's (ARPA-E) rigorous project management efforts—across its portfolio of projects and is currently applying lessons learned to further refine our management of risk within the portfolio. These approaches provide clearer accountability through: more clearly defined roles and responsibilities in project execution by establishing uniform position requirements across the organization; enhanced project management standard operating procedures; guidance to more effectively negotiate detailed statements of project objectives for each project,

including quarterly progress reviews and annual “Go/No-Go” milestones; and end-of-project deliverables clearly oriented around accomplishments that can impact the energy marketplace.

By implementing rigorous Active Project Management principles, EERE has increased the rate at which we discontinue projects for technical reasons, meaning those that are unable to meet their targets or fulfill their original intent.

- Q3b. What percentage of the Office of Energy Efficiency and Renewable Energy’s funding supports research, development, and demonstration efforts, versus the percentage that supports deployment and commercialization activities?
- A3b. Approximately two-thirds (66 percent) of EERE’s programmatic budget request (exclusive of corporate support activities such as program direction and funding for research and development facilities at the National Renewable Energy Laboratory) directly supports research, development, and demonstration activities. Approximately 24 percent supports commercialization and deployment activities. Most deployment funding is distributed to States and localities via formula-based weatherization assistance grants and the State Energy Program. The remaining 10 percent of EERE’s programmatic budget request supports other essential activities such as return-on-investment analyses, technology integration, R&D management, and congressionally mandated standards development.
- Q4. In the FY 2016 budget proposal for EERE, reducing market barriers to new technology is listed as a primary goal, specifically addressing “lack of reliable information, inconsistent regulatory environments, and workforce training gaps.” Does the Department provide other forms of energy with assistance addressing these challenges, or is this goal only for renewable energy?
- A4. There is a strong Departmental focus on addressing the “lack of reliable information, inconsistent regulatory environments, and workforce training gaps.” Workforce training is a top priority of mine, as evidenced by the four traineeship program requests included in FY 2016 Budget Request in the Offices of Nuclear Energy, Science, Environmental Management, and Energy Efficiency and Renewable Energy. Improving availability of public information about emerging technologies is a mantra for all the applied energy

offices, which typically invest in either cost-shared research, development and demonstration projects to advance the state of technology commercialization or in grant-supported research that is made publicly available. I would also note that the Energy Information Administration is widely-recognized as the world-leading source for objective, survey-based statistical information about the energy landscape, including fossil, nuclear and other energy sources. Though the Department has a limited role in direct regulation beyond a few specific areas, we place strong emphasis on outreach and engagement with other agency, state, municipal, local and tribal authorities with regulatory responsibilities. In most cases, the Department is called upon to provide its technical expertise to inform and sometimes directly support development of regulatory processes and structures.

- Q4a. Does the Department agree that coal and natural gas also face “inconsistent regulatory environments” under EPA’s power plant regulations?
- A4a. As the President’s FY 2016 Budget Request states [DOE FY16 Vol. 3, p. 10], an “inconsistent regulatory environment” (typically resulting from overlapping Federal, state, regional, or local authorities) is just one of the market barriers that new energy technologies face in competing with incumbent systems that are the products of years of technology validation and, often, taxpayer and regulatory support. Natural gas and coal power systems are technologically mature – together providing about 70% of the nation’s electricity – and operate in well-established regulatory environments. The Department of Energy continues to conduct a wide range of RD&D on advanced carbon capture and storage technologies for coal and natural gas and on technologies for the prudent and sustainable development of domestic unconventional resources, however, because they address environmental externalities of fossil fuel production and use. The Environmental Protection Agency’s proposed power plant regulations will provide a uniform regulatory framework in which these and other energy technologies can compete, while giving States the flexibility to determine the appropriate generation mix to meet future public needs.
- Q5. ARPA-E was designed to sponsor “high potential, high-impact energy technologies that are too early for private sector or other DOE applied research and development

investment,” targeting innovative ideas that struggle to find investors in the private sector. But approximately 19% of ARPA-E’s project funding goes to large businesses. How does providing funding to large business, which should be able to readily access capital for research and development, meet ARPA-E’s mission?

What steps have been taken to ensure recipients of ARPA-E funding have thoroughly searched and been unable to access private investment?

- A5. The Advanced Research Projects Agency – Energy (ARPA-E) catalyzes transformational energy technologies that could create a more secure and affordable American future, in accordance ARPA-E’s statutory authority, by “ identifying and promoting revolutionary advances in fundamental and applied sciences;... translating scientific discoveries and cutting-edge inventions into technological innovations; ...and accelerating transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty.” 42 U.S.C. § 16538 (c)(2). ARPA-E focuses on energy technologies that can be meaningfully advanced with a relatively small investment over a defined period of time. ARPA-E’s rigorous program design, competitive project selection process, and hands-on engagement, ensure thoughtful expenditures while empowering America’s energy researchers with funding, technical assistance, and market awareness.

All applications for ARPA-E program funding include a Business Assurances & Disclosures Form, which is certified by the applicant and reviewed by ARPA-E as part of the selection process. The form must be certified and includes a notice that, for any false statements, the applicant may face civil and/or criminal penalties pursuant to 18 U.S.C § 1001. The Business Assurances & Disclosures Form includes the applicant’s description of the technical and market risks associated with the proposed projects, as well as a description as to why the applicant/project team needs ARPA-E funding. In addition, large business applicants must also describe why the proposed project is not supported internally, and all applicants must disclose any pending or current funding for the proposed project, or related work.

- Q6. EERE provides a portion of its funding to “Incubator” programs designed to develop innovative technologies that are not currently represented in its technology offices. How

does the Department prevent duplication between these programs and ARPA-E's initiatives?

- A6. The Incubator program is complementary to and distinct from activities funded by the Advanced Research Projects Agency – Energy (ARPA-E). ARPA-E supports early-stage development with the objective of establishing new learning curves – to create entirely new options for transformative energy technologies.

EERE is an organization focused on achieving aggressive and well-defined mid-to-long term clean energy goals for the United States of America. In that context, EERE has established multi-year plans and roadmaps. This roadmap-based approach is one of EERE's greatest strengths, but it can create challenges in recognizing and exploring unanticipated, game changing pathways that may ultimately be superior to the pathways/approaches on our existing roadmaps.

The EERE Incubator programs explore bridges between emerging technologies and existing roadmaps – to further integrate new learning curves (created by ARPA-E or others) into revised technology roadmaps. EERE's incubators play an important role in enhancing the openness of our programs and the diversity of our technology solution pathways to make sure we are able to integrate new, potentially game-changing ideas into our portfolio. Incubator funding opportunity announcements are designed to target these new approaches, which are not represented in our current roadmaps. Incubators are housed within individual EERE technology offices, and focus on supporting the mission of that office, as authorized by Congress. In FY16, EERE is requesting to continue to include a small fraction of its annual funding for Incubator programs within each of its technology offices.

The Incubator programs were built based on the successful model of the SunShot Incubator Program, which was established in 2007. Since the SunShot Incubator Program was created, DOE estimates that approximately \$100M has been invested in 100 awards and has leveraged \$1.8B in follow-on private investment.

- Q7. The Natural Gas program provides \$19 million for multi-agency research and development focused on “high-priority challenges to safe and prudent development of

unconventional oil and gas resources.” This research is conducted in partnership with the Department of Interior and the EPA, dating back to 2012. Can you provide additional details on the accomplishments to date and ongoing goals of this collaborative research?

- A7. The collaborative and coordinated relationship among the three agencies grants the opportunity for increased sharing of (a) data and models to help improve predictive capabilities in areas such as resources characterization, water quality, and induced seismicity; (b) measurement strategies, methodologies, and techniques; and (c) useful information on recently completed or ongoing research, and associated insights that improves each agency’s research portfolio.

Examples of DOE’s accomplishments, which are shared with the other member agencies, include:

- A project aimed at developing a sustainable approach for water management in the Marcellus shale play showed that treated acid mine drainage water can be mixed with flow-back water from production reducing the amount of freshwater used for hydraulic fracturing.
- Development of new and improved technologies for treating produced water including the development of a technology that effectively removes benzene, toluene, xylene, light oils, and dispersed and total solids from produced water.

The research goals include (a) reducing the surface and subsurface impacts of development; (b) assessing wellbore integrity practices, identifying materials for improved wellbore design, and applying models to explore the potential for gas or fluid migration from poor, incomplete, or degraded well cementing; (c) developing hydraulic fracturing technologies that require less water consumption and/or alternative waterless technologies; (d) assessing the current capabilities of control strategies and measures to reduce emissions; and (e) developing models for assessing the likelihood of induced seismic events and validating models with lab experiments and field data.

- Q8. The Natural Gas program includes \$15 million for a new subprogram on mid-stream natural gas infrastructure, as well as \$10 million for a subprogram on emissions quantification from natural gas infrastructure throughout the natural gas supply chain. With these two subprograms, it appears the majority of the Natural Gas program budget

is dedicated to emissions quantification and reduction efforts – is any funding from this program going to research and development for new production technology?

- A8. Under the proposed Emissions Mitigation from Midstream Infrastructure R&D subprogram, DOE would initiate research to develop technology to reduce emissions focusing on compressor emissions and performance controls, pipeline inspection and repair technologies, and smart sensors to provide better flow rate quantification and enable more efficient pipeline operations.

The Emissions Quantification from Natural Gas Infrastructure subprogram's research will update and improve the methods used to calculate methane emissions from the entire natural gas value chain, and will work with the EPA to factor those calculations into the national Greenhouse Gas Inventory.

- Q8a. With the decision to once again zero out the Unconventional Fossil Energy Technologies program in the budget proposal, does this mean the Department is spending zero dollars on oil and gas production research and development?
- A8a. Under the Environmentally Prudent Development subprogram, DOE funds research and development activities that address issues associated with safe and environmentally sustainable development of unconventional oil and natural gas resources. These include (a) developing technologies that will reduce the surface and subsurface impacts of development in the context of economic factors, industry capacity, and the potential intensity of future development activity and (b) identifying and developing technologies and new approaches that can reduce the environmental impacts and footprint of development through smarter and smaller stimulations.
- Q9a. Secretary Moniz, one of your management initiatives at the Department was the creation of an Under Secretary for Science and Energy in the FY 2015 budget, designed to create more coordination between the science and applied energy research and development at DOE.

Other than shifting the organizational chart around, what has changed? Can you describe how the science and applied energy programs work together in a more coordinated manner than they did before the creation of this position?

A9a. The creation of an Under Secretariat for Science and Energy has resulted in significantly increased coordination across the science and energy portfolio. Importantly, greater collaboration is occurring at all levels of the science and energy organizations, with many tangible outcomes. To highlight just a few:

- Under the aegis of the Under Secretary for Science and Energy, the Department established tech teams including representatives with subject matter expertise from science, applied energy and other organizations around the Department, and tasked them with preparing crosscutting budget proposals aimed at better leveraging existing investments as well as identifying new opportunities for impactful research areas of shared interest. These teams produced a series of “Budget Crosscut” proposals that ultimately integrated over \$1 billion of the Department’s total FY 2016 Budget Request. Importantly, the coordination across these teams extends beyond budget planning; they also serve as a conduit for better coordinated communication with external stakeholders and as a node for more proactive synchronization of program execution, as evidenced by a joint request for information to the subsurface community issued recently by the Subsurface Engineering and Technology R&D Crosscut Team.
- The Department held its second annual Laboratory Ideas Summit in April 2015, in which the science, energy, and nuclear security labs generate and present ideas for innovative new research directions for consideration by the Department. Several of last year’s laboratory ideas were incorporated into budget crosscuts and program proposals that featured prominently in the Department’s FY 2016 Budget Request. Institutionalizing these changes is an ongoing goal and necessary to ensure continued success and innovation in the coming decades.
- The Department’s 2015 Quadrennial Technology Review, which is expected to be released later this summer, is being led by the Under Secretary for Science and Energy. It will dedicate significant space to discussion of enabling scientific research and facilities as a platform for applied energy technology development.
- On a regular basis, the Under Secretary for Science and Energy convenes the principal leadership and senior managers of the science and energy programs to discuss issues of shared interest and common opportunity. These meetings and the

discussions coming out of them have led to a series of cooperative efforts, including but not limited to initiatives to increase coordination of lab annual operating plans, lab performance management, and Departmental STEM traineeship programs, as well as setting common direction (through both budget planning and coordinated execution) toward shared research and development goals that span the innovation chain from basic research to commercial deployment.

- Q9b. Was the FY 2016 budget proposal for DOE Science and Energy programs developed under a review process managed by the Under Secretary's office?
- A9b. Yes, as part of our internal budget deliberations, I rely on the Under Secretary for Science and Energy to provide recommendations to me on proposed budget submissions for the Offices of Science, Energy Efficiency and Renewable Energy, Fossil Energy, Nuclear Energy, Electricity Delivery and Energy Reliability, Indian Energy Policy and Programs, and the Office of Technology Transitions.
- Q10a. How do you evaluate whether DOE program offices are meeting the stated goals that are outlined in the Department's annual budget request? Do the program offices self-evaluate, or is progress towards stated goals evaluated by a separate entity at the Department?
- A10a. As evidenced by the establishment of an Under Secretariat for Management and Performance, I consider a focus on Departmental performance and performance management to be critical in our constant efforts to maximize taxpayer dollars, particularly around improved project management. At a Departmental level, all program goals align with the DOE Strategic Plan, and a review of all agency priority goals is conducted each quarter by the Chief Operating Officer, in accordance with the guidelines established in the Government Performance and Results (GPRA) Modernization Act of 2010. Within each program, there is also rigorous evaluation, including, in many cases, by external peer review (e.g. Gasification Systems, Hydrogen Turbines, and Solid Oxide Fuel Cell peer reviews in the Fossil Energy portfolio) and Federal Advisory Committees (e.g. Nuclear Energy Advisory Committee, Electricity Advisory Committee, Basic Energy Sciences Advisory Committee, High Energy Physics Advisory Panel, to name a few). At the program level, performance goals are established with quantitative targets

and time frames. These performance goals are also reviewed quarterly. In this way, program offices are evaluated internally within DOE, against performance metrics established within the Federal Performance Framework.

Q10b. How well does the current evaluation process work, and how might you make it more effective and transparent?

A10b. The current evaluation practices in place are highly effective and ensure that rigorous leadership oversight exists at all levels of the Department and that external review is occurring as well. In addition to the quarterly performance reviews by the Deputy Secretary on the Agency Priority Goals, the Department relies on a number of evaluation tools and processes. For example, the Department rigorously works to implement corrective actions related to recommendations contained in Inspector General and Government Accountability reports. In addition, to improve evaluation in the area of project management, the Department recently strengthened the Energy Systems Acquisition Advisory Board (ESAAB), establishing a Project Management Risk Committee comprised of the most senior project management officials from each Under Secretary's office to advise the ESAAB, and improve the lines of responsibility and the peer review process. The Department will be undergoing an internal review of its agency priority goals and performance measures for tracking and measurement starting in FY 2016 and will make this information available as it has in the past.

Q11a. Please provide the following information on the management structure for DOE's proposed crosscutting initiatives outlined in the FY 2016 budget request – How will the Department manage these crosscutting initiatives?

A11a. Crosscutting initiatives propose coordinated co-funding of critical research thrusts with shared benefits across multiple program offices. Based on final appropriations, the leadership teams for the programs involved in a budget crosscut will assess how best to pursue shared mission goals and coordinate with the crosscut team to leverage resources for the shared benefit of contributing programs. Once resource support has been defined, programs will continue to coordinate through the crosscut team structure on the portfolio of work proposed in the FY 2016 budget request. In some cases, where a crosscut was funded by prior appropriations, a more formal structure has been established, as is the

case with the Grid Modernization Lab Consortium (GMLC). Through the GMLC, a steering committee at the program principal level incorporates input from a Federal Advisory Committee and provides direction to federal and laboratory leads who then implement a coordinated research effort across six identified thrust areas and are held accountable for doing so. It is important to note that budget authority ultimately resides within each of the contributing program offices and that those programs must first abide by any authorizing and appropriations statutory requirements they are subject to before dedicating resources to crosscutting or other activities.

Q11b. Who will provide oversight to ensure research conducted under the crosscuts will truly advance key technology across energy resource applications, not just fund research that seems related to stated goals?

A11b. As noted above, budget authority ultimately resides within each of the contributing program offices and those programs will at all times abide by any authorizing and appropriations statutory requirements they are subject to. As also discussed above, program leadership sets direction for and maintains control over the funding and implementation of that funding as part of a crosscut. Research pursued through any crosscut will always directly benefit the program providing funding for that effort.

Q11c. In the Office of Fossil Energy's contribution to the Subsurface and Technology and Engineering crosscut, "material impact on climate change via CO₂ storage" is referenced as a primary goal for the initiative. Is studying the impact of climate change an effective use of funds and expertise within the Office of Fossil Energy?

A11c. The Office of Fossil Energy (FE) will fund four research thrusts through the Subsurface Crosscut, all focused on adaptive control of subsurface fractures and fluid flow. These thrust areas – wellbore integrity, stress state and induced seismicity, permeability manipulation, and new subsurface signals - are all directly related to FE's core mission. A primary goal of the overall FE R&D portfolio is to reduce greenhouse gas emissions through investments in carbon capture and storage technology development. Many of FE's contributions to the Subsurface Technology and Engineering Crosscut center around the Office's goal to develop and validate technologies for the safe and permanent geologic storage of captured CO₂.

Q12a. President Obama's Executive Order 13563 addresses redundant and burdensome government regulations and states as a general principle that agencies should "identify and use the best, most innovative, and least burdensome tools for achieving regulatory ends." Voluntary Independent Certification Programs (VICPs) deploy ready-made, cost-effective programs to reduce burdens on regulated businesses. Congress has already directed the U.S. Department of Energy (DOE) to use third-party certification for certain products and both the Energy Independence and Security Act of 2007 and the Energy Policy Act of 2005 clearly instruct DOE to rely on third-party certification programs for commercial refrigerators, furnaces, central air conditioners, and heat pumps when available.

Can you identify any long-standing private sector VICPs that provide testing and certification of HVACR products and explain?

A12a. The Appliance Standards Program is the DOE regulatory program responsible for implementing the Federal energy conservation program for appliances and industrial equipment established by Congress. Compliance with those standards, many of which were enacted directly by Congress, is determined through testing of covered products and equipment. A *verification program* typically verifies manufacturer's efficiency ratings through periodic testing of models and requires participants to revise ratings based on those test results. A *certification program* typically provides verification of efficiency ratings through review of paperwork submittals by manufacturers, as well as providing an endorsement by the certifying body regarding the veracity of the claims.

DOE is aware that one trade organization (the Air-Conditioning, Heating, and Refrigeration Institute – AHRI) and several third-party laboratories provide manufacturers with the option of enrolling in their third-party certification program for commercial refrigerators, furnaces, central air conditioners, and heat pumps, such a program is commonly referred to as a Voluntary Industry Certification Program (VICP) within industry.

AHRI's VICP, in addition to reviewing summary ratings data submitted by participants, also conducts some testing and provides a listing service for participants in its certification program. AHRI's program requirements do not align with Federal regulations in all respects.

The certification programs run by the third-party laboratories are generally traditional certification programs.

Q12b. Can you describe the consideration DOE has given to utilizing existing VICPs to fully ensure verification and compliance with federal energy conservation standards?

A12b. A voluntary verification program can play an role in ensuring the validity of efficiency ratings. For example, DOE and the Association of Home Appliance Manufacturers (AHAM) currently have an agreement in place whereby AHAM ensures compliance with ENERGY STAR specifications for products in AHAM's program in lieu of DOE running a taxpayer-funded verification program.

DOE announced its willingness to work with the heating, ventilation, air conditioning, and refrigeration (HVACR) industry to establish potential requirements for a DOE-approved voluntary verification program similar to that established with AHAM. DOE began negotiated discussions with industry, trade organizations, third-party laboratories, and energy-efficiency advocacy groups regarding a DOE-approved verification program for commercial refrigerators, air conditioners and heat pumps, and furnaces during the summer of 2013. DOE presented a number of ideas for consideration and discussion about the minimum requirements for a DOE-approved verification program with the goal of establishing an agreement similar to that in place with AHAM. When these negotiations stalled, the Appliance Standards Rulemaking Federal Advisory Committee (ASRAC), which includes several major manufacturers of the aforementioned products, voted to cease negotiations due to the disparate views expressed by the various industries, testing organizations, small domestic businesses, importers, global manufacturers, etc., leading to a failure to negotiate an agreement.

Product certification is another key element of the Appliance Standards Program. Industry, DOE, and energy efficiency advocates worked for four months in 2013 negotiating certification requirements for commercial HVAC, refrigeration, and water heating equipment. The requirements negotiated during that process are currently being phased-in, with the last equipment category - requiring manufacturers to certify compliance with Federal standards for the first time - due on July 1, 2015. DOE has

found that, as it has instituted certification requirements for similar products in 2011 as well as the products covered under the negotiated provisions, that a lack of a requirement to submit a manufacturer's certification of compliance correlates closely with lack of compliance with testing and Federal standards, some of which were enacted by Congress. When manufacturers are not required to certify compliance, those manufacturers frequently do not test, and the products are more likely not to meet Federal minimum standards. DOE's current certification regulations allow manufacturers to use third-parties, such as an industry association or a third-party laboratory, to submit compliance certification reports to DOE. Thus, a subset of manufacturers of commercial refrigerators, central air conditioners and heat pumps, and furnaces currently utilize a third-party, such as AHRI or one of various laboratories, to submit compliance certification reports on the manufacturer's behalf to DOE.

Q12c. Is DOE currently considering a rule that would create a new DOE-based verification program for HVACR products?

A12c. DOE supports the creation of a DOE-approved verification program and believes it can play an important role in helping to "self-police" within an industry; however, it should not supplant the Federal government's role in enforcing federal law. A verification program can help test a wider range of products on the market, which can create a greater deterrence to noncompliance than a government-run testing program. However, DOE currently does not have an open rulemaking to create a DOE-approved verification program for HVAC and refrigeration products. As previously noted, DOE attempted to negotiate a rule that would establish some form of DOE recognition for voluntary independent verification programs. When that negotiation stalled, the Appliance Standards Rulemaking Federal Advisory Committee, a committee established under the Federal Advisory Committee Act and composed of members from industry, energy advocacy groups, utilities, and testing organizations, voted to cease negotiations due to the disparate views expressed by the various industries, testing organizations, small domestic businesses, importers, global manufacturers, etc., leading to a failure to negotiate an agreement. DOE takes the recommendations of the advisory committee seriously; if the consensus view of all of the interested parties is that DOE should

proceed, DOE believes that there is broad-based interest and is certainly willing to proceed again with either a traditional notice and comment rulemaking or a negotiated rulemaking.

- Q12d. Has DOE suggested ways to enhance VICPs to ensure that private sector verifications are conducted in a manner that eliminates the need for a taxpayer-funded verification program? If so, please describe the manner in which DOE has done so.
- A12d. Yes, as part of the negotiations on commercial HVAC, refrigeration, and water heating certification, DOE presented a number of ideas for consideration and discussion about the minimum requirements for a DOE-approved verification program with the goal of establishing an agreement similar to that in place with AHAM. Topics included: allowance of all participants without a requirement to join a membership group, allowance of DOE input on product selection for verification testing, providing a public list of all models participating in the program, providing a list of models that will be subject to verification testing over a specified time period, providing DOE with the test results of all models subject to verification, providing a documented process for procurement, testing to the applicable DOE test procedure only, providing a process for DOE involvement in the case of test procedure interpretation questions, referral of all test failures to DOE immediately prior to notification of the manufacturer for proper enforcement, and a manual for DOE review and approval that outlines all the procedures. Such a manual would include allowable manufacturer-program-lab interaction and a process for determining program failures. As noted above, DOE has entered into an agreement with respect to ENERGY STAR verification testing with an industry verification program run by the Association of Home Appliance Manufacturers. See <http://energy.gov/eere/buildings/downloads/aham-doe-verification-test-agreement>. DOE has stated publicly that it would be willing to initiate the same process with other verification programs if they were interested in entering into a similar agreement. DOE would initiate a rulemaking to consider verification testing more broadly, particularly if the Appliance Standards Rulemaking Federal Advisory Committee were to conclude that negotiations could reach fruition at this point in time.

- Q12e. How would a proposed DOE verification program run more effectively, cost less taxpayer money, and produce better results than the current VICPs?
- A12e. DOE does not seek to administer a verification program that mimics those currently administered by industry associations and believes a DOE-approved verification program can play a role in helping to “self-police” within an industry. However, such a program cannot supplant the Federal government’s role in enforcing federal law. Instead, DOE envisions a collaborative approach that takes full advantage of, and does not needlessly duplicate, current verification programs. DOE approval and oversight would ensure equity amongst different verification programs for the same products, regardless of the size of the business. A DOE-approved verification program would also insure that small businesses that cannot afford to participate in a voluntary verification program, which can cost businesses thousands of dollars to join, would not be inappropriately disadvantaged. DOE could periodically review the procedures and processes of the verification program to ensure that DOE’s regulations were being implemented correctly by an industry-run program.

Product testing provides a wealth of information to DOE that is used in all aspects of its appliance standards program, especially in the area of test procedure development. Sharing of test data and testing experiences is vital to the DOE’s ability to ensure that DOE’s regulations stay current, reflect new technologies, and are not unduly burdensome. Ensuring DOE has the tools to respond quickly to product innovation ensures that the regulatory program is less expensive for businesses. Most VICPs, however, do not engage in this level of coordination and information sharing with DOE. Indeed, some have indicated that they do not feel free to share information with DOE at the level of detail and frequency with which DOE believes is necessary to administer an effective regulatory program.

- Q13. As part of the President’s Climate Action plan, the Department of Energy set 10 efficiency standards for appliances and equipment in 2014, and has suggested up to 12 new efficiency standards in 2015. DOE’s “Process Rule” involves early input from stakeholders, increased predictability, and a thorough analysis of costs/benefits.
- a. Please describe how DOE has complied with the Process Rule in the development and finalization of the 10 standards in 2014. For each standard, please describe

the nature of any stakeholder outreach by DOE and any efforts by DOE to develop a consensus-driven standard.

- b. Please describe how DOE intends to comply with the Process Rule for the 12 standards currently in development over the next two years. For each standard, please describe the nature of any stakeholder outreach by DOE and any efforts by DOE to develop a consensus-driven standard.

- A13. The guidance issued by the Department at 10 CFR part 430, Appendix A to Subpart C, describes procedures, interpretations, and policies for the development of new or revised energy-efficiency standards for certain products. These guidelines are designed with stakeholders in mind to provide for greater and more productive interaction between the Department and interested parties throughout the rulemaking process. This enhanced interaction, in turn, has enhanced the quality of the resulting rules, most typically through additional analysis conducted as issues are raised by stakeholders.

The Department seeks to engage stakeholders actively in its energy conservation standards rulemaking process through a number of different steps, each of which involves an opportunity for public comment and a public meeting. The Department's energy conservation standards rulemaking process typically begins with a framework document, which describes the data the Department will seek for the rulemaking, the issues the Department believes will be presented and a description of the analyses the Department will perform. The framework stage results in publication of the second document in the process, a preliminary analysis. The preliminary analysis presents the data gathered from the framework stage and the initial results of the analyses performed. At preliminary analysis stage the Department suggests possible efficiency levels without making a specific proposal. Only after both of these stages are complete, does DOE initiate the typical notice and comment rulemaking process.

In November 2010, DOE announced that it would, in appropriate cases, implement changes to further improve its rulemaking process while maintaining collaboration and interaction with stakeholders. See <http://energy.gov/eere/buildings/plans-and-schedules>. First, the Department stated that it would seek to engage in negotiated rulemakings, a collaborative process in which the government and interested stakeholders create a

consensus proposal for a rulemaking. Over the past several years, the Department has engaged in nine negotiated rulemakings, virtually all of which resulted in a consensus. And, in those few instances where consensus was not achieved, the ensuing rulemaking was better informed and tailored to the issues as a result of having engaged in the process. The participants in these negotiated rulemaking all appreciated the process.

Next, the Department stated that, in appropriate cases, the Department may gather preliminary data informally and begin the public rulemaking process with the issuance of a Notice of Proposed Rulemaking (NOPR) for public comment. That is, in certain instances, the Department might seek to accomplish the outcome of the framework and preliminary analysis stages through alternatives means. For example the Department has found that publishing a Request for Information (RFI) requesting input and data from interested parties to aid in the development of the technical analyses is an effective means to receive input and comments on issues relevant to the conduct of a rulemaking. In other circumstances, DOE might publish a Notice of Data Availability (NODA) containing the analysis and the underlining assumptions and calculations, which may be used to ultimately support a proposed energy conservation standard. DOE encourages stakeholder comment on all of these documents – whether the RFI, NODA or NOPR -- and invites additional data or information that may improve the analysis.

Whereas the informal steps of the rulemaking process may vary depending on the particular circumstances of the product in question, the Department always maintains an open, consultative process that actively encourages the participation and interaction of all stakeholders. The Department intends to continue robust stakeholder outreach going forward with upcoming standards, including confidential interviews with manufacturers, public meetings, and negotiations with interested parties, among other forms of stakeholder outreach.

QUESTION FROM REPRESENTATIVE JIM SENSENBRENNER

Q1a. On October 22nd, the Department of Energy announced more than \$53 million for 40 solar research and development (R&D) projects designed at reducing costs and addressing key aspects of technology development for next generation photovoltaic (PV) solar technologies and advanced manufacturing processes. As a part of this initiative, \$14 million in funding was provided through the SunShot Incubator program to 20 solar companies.

Can you provide detailed information on the selection process for these companies?

A1a. The full application process for SunShot Incubator can be found in the Funding Opportunity Announcement (FOA) in Section II.B (FOA: <https://eere-exchange.energy.gov/FileContent.aspx?FileID=ba893c9e-17a3-46b6-95d5-6a5b26cf1ba1>).

In summary, DOE carefully considers all of the information obtained through the application process (e.g., full applications, reviewer comments, replies to reviewer comments, and information obtained through the on-site merit review discussions with expert reviewers, pre-selection conference calls, meetings and presentations) and evaluates each compliant and responsive full application based on the criteria and program policy factors in the Funding Opportunity Announcement (Sections V.A.1 and V.A.2 of FOA). DOE may select or not select a full application for award negotiations. Applicants were then provided with a schedule for award negotiations upon selection.

Q1b. What metrics were used to assess the viability of awardees before funding was provided through the Incubator program?

A1b. Applicants' full applications are evaluated against several review criteria, which can be found in the SunShot Incubator Funding Opportunity Announcement (FOA) (<https://eere-exchange.energy.gov/FileContent.aspx?FileID=ba893c9e-17a3-46b6-95d5-6a5b26cf1ba1>) in Section V.A.3 (pages 69-71). These criteria include:

1. Potential Impact on the Installed Price of Solar. This includes factors such as: extent of the innovative and disruptive potential to dramatically reduce costs to meet the SunShot Initiative goals; contribution to domestic manufacturing; and likelihood of business success; among other factors as described in the FOA.

2. Quality of the Proposed Project Plan. This includes factors such as: extent that the applicant shows a clear understanding of the importance of verifiable deliverables; quality of the applicants proposed deliverables validation methodology; and adequacy, value, and reasonableness of the schedule and quality of the plan in advancing stated project outcomes, while addressing the expected barriers and risks; among other factors as described in the FOA.
3. Capability and Resources of the Applicant/Project Team. This includes factors such as: extent to which the training, capabilities and experience of the assembled team will result in the successful completion of the proposed project; extent to which the Statement of Project Objectives shows a mastery of the skills required to complete the proposed project; and extent to which this team has shown success in the past; among other factors as described in the FOA.

Full Applications are reviewed by no fewer than three expert reviewers using the criteria and relative weighting described above. The results of these reviews provide detailed strengths and weaknesses comments and associated scores on a scale of 0-10 for each of the three criteria stated above.

Once the reviewers have completed their independent review of the applications, the comments (but not the scores) are available for review by the applicant for a short time in which a reply to reviewer comments can be submitted to address key concerns expressed by the expert reviewers. The replies to reviewer comments are considered part of the full application and are reviewed using the same criteria. A merit review is then held with independent reviewers and the designated federal reviewers to discuss the merits of the various applications based on the criteria above.

- Q1c. What steps were taken to ensure responsible use of government funds through this initiative, and what steps will the Department take to ensure funding provided is used for technology development?
- A1c. To ensure good stewardship of taxpayer resources, the Solar Energy Technologies Office (SETO) requires applicants to clearly define and quantify current baseline status at the start of the project; provide several interim deliverables to demonstrate incremental progress towards

the project objective; and a final deliverable that include verifiable outcomes that should encompass the requirements needed to fully substantiate the exit criteria of the award.

EERE has also implemented Active Project Management approaches—inspired by the Advanced Research Projects Agency–Energy’s (ARPA-E) rigorous project management efforts—across its portfolio of projects and is currently applying lessons learned to further refine our management of risk within the portfolio. These approaches provide clearer accountability through: more clearly defined roles and responsibilities in project execution by establishing uniform position requirements across the organization; enhanced project management standard operating procedures; guidance to more effectively negotiate detailed statements of project objectives for each project, including quarterly progress reviews and annual “Go/No-Go” milestones; and end-of-project deliverables clearly oriented around accomplishments that can impact the energy marketplace.

By implementing rigorous Active Project Management principles, EERE has increased the rate at which we discontinue projects for technical reasons, meaning those that are unable to meet their targets or fulfill their original intent. In addition to evaluating quarterly reports from the awardees, DOE SETO project managers engage in regular, monthly calls to ensure the project is on track and help the awardee execute on project objectives.

QUESTIONS FROM REPRESENTATIVE DAN NEWHOUSE

- Q1. The President has proposed a new cross-cutting activity to study and model the interdependencies of the nation's energy and water systems. Washington State has abundant water resources and those resources are the foundation of our economy. In addition to supporting our fisheries, forestry, and agriculture industries, hydropower has made Washington an attractive state for the high-tech industry. I certainly appreciate the critical interdependencies of energy and water. But I would like to know what's really new here. What decision, relevant tools or information would you expect from this proposed crosscut? I know DOE already has other models of energy and water resources, so why propose a major new activity to look at this issue?
- A1. In June 2014, the Department of Energy (DOE) released a report entitled *The Water-Energy Nexus: Challenges and Opportunities*, which established a framework that the DOE has used as a foundation to identify opportunities to leverage its capabilities and infrastructure for the Nation's benefit in better characterizing coupled energy-water systems and improving their resiliency. This framework is the foundation for the FY 2016 proposal for coordinated investments to advance data, modeling and analysis; technology development; and policy analysis and stakeholder engagement.

The Energy-Water Crosscut emphasizes a data, modeling, and analysis platform to further improve understanding and inform decision-making for a broad range of users. Largely funded through the Office of Science, the data, modeling and analysis (DMA) focus is a means to understand current energy system vulnerabilities while exploring complex systems dynamics for subsequent applications in planning the resilience, efficient, and competitive energy-water systems of the future. Current models are not robust enough for informed decision making, and the crosscut efforts will advance foundational models, produce and analyze modeled output, and integrate data sets at spatial and temporal scales that matter to decision-makers at Federal, regional, state, and municipal levels and enable them to understand the interplay among energy, water, and other systems at various scales.

Moving forward, the DMA platform will help DOE to target future technology R&D and technology assistance efforts to the greatest challenges and opportunities in improving resiliency of coupled energy-water systems. Based on analysis completed thus far, the crosscut strategically targets two areas of technology R&D:

- Treatment, management, and beneficial use of non-traditional waters in energy systems will advance treatment technologies for producing potable water through carbon capture and storage and develop technologies and management practices for hydraulic fracturing to reduce the volume of freshwater demand, produce less water that requires disposal, and recycle flowback water as alternatives to the use of 100 percent freshwater for oil and gas extraction.
- Sustainable low energy water utilities will pursue processes, technologies, and systems that increase energy efficiency and energy recovery for water and wastewater treatment. This will include both enhanced technical assistance and R&D in areas such as more energy efficient pre-treatment for anaerobic digestion processes, gasification, and pyrolysis; reductions in the energy intensity of denitrification, and more energy efficient biosolid to energy conversion processes.

The crosscut proposal also funds policy analysis, outreach, and stakeholder engagement to better target and leverage DOE investments in unique regional, state, and local contexts.

- Q2. A law was passed by Congress and enacted into law last year establishing a Manhattan Project National Park comprised of historic facilities like Hanford's B Reactor. Is the Department of Energy committed to taking the actions necessary to establish this Park – including working with the local communities, finalizing the appropriate MOU's, and requesting the necessary funding required to carry out the Department's responsibilities under the law?
- A2. Yes. DOE and the National Park Service (NPS) are working together to establish the Manhattan Project National Historical Park by the end of December 2015, consistent with the FY 2015 National Defense Authorization Act. DOE and NPS are working well together on the Memorandum of Agreement, and are in the midst of site visits. Before finalizing the agreement, DOE and NPS will consult with interested state, county and local officials in the Manhattan Project communities, as well as key advocacy organizations and members of the public. I appreciate your interest, and I look forward to working with you on this new, innovative park model.

- Q3. Can you outline in detail how the Department of Energy is spending and plans to spend remaining Fiscal Year 2015 funds appropriated for work within the River Corridor Closure project at Hanford?
- A3. Cleanup progress at the Richland Operations Office is a priority for the Department. There has been tremendous progress at Richland, and the Department's FY 2016 Budget Request focuses on continuing to make progress. For the River Corridor Closure Project at Hanford, the FY 2015 funds will be used for remediation of 54 waste sites, operation of the Environmental Restoration Disposal Facility and site-wide infrastructure services.
- Between now and the end of FY 2016, EM plans to continue work, including completion of design and mockup to ensure we know how to safely clean up the 324 building, and completion of the trench work at the 618-10 burial ground.
- Q4. Are there any current milestones in the 300 Area that are at risk of being missed as a result of the FY 2016 budget?
- A4. No, the FY 2016 budget supports compliance with 300 Area milestones.
- Q5. What milestones are currently being missed or are at risk of being missed involving cleanup work under the purview of the Richland Operations Office?
- A5. The Department is actively working to meet its cleanup commitments under the purview of the Richland Operations Office. To the extent milestones are delayed, DOE will follow the provisions under the Tri-Party Agreement for making notifications and working with the U.S. Environmental Protection Agency and the Washington State Department of Ecology regarding schedule adjustments if necessary.
- Q6. The Plutonium Finishing Plant is scheduled to be slab-on-grade by the end of Fiscal Year 2016. Once funding for PFP is no longer needed, is the Department committed to using these funds for other legally required cleanup work under the purview of the Richland Operations Office?
- A6. EM continues to pursue its cleanup objectives safely within a framework of regulatory compliance commitments and best business practices. The rationale for cleanup prioritization is based on achieving the highest risk reduction benefit per radioactive content (activities focused on wastes that contain the highest concentrations of

radionuclides and sites with the highest radionuclide contamination). Taking many variables into account, EM generally prioritizes its cleanup activities as follows:

- Activities to maintain a safe, secure, and compliant posture in the EM complex
- Radioactive tank waste stabilization, treatment, and disposal
- Spent (used) nuclear fuel storage, receipt, and disposition
- Special nuclear material consolidation, stabilization, and disposition
- Transuranic and mixed/low-level waste disposition
- Soil and groundwater remediation
- Excess facilities deactivation and decommissioning.

Q7. Can you please provide an update on work to transfer a portion of Hanford land no longer needed for cleanup to the Community Reuse Organization as required under the 2015 National Defense Authorization Act?

A7. The land transfer requires completion of multiple regulatory processes including, but not limited to, the National Environmental Policy Act, the National Historic Preservation Act Section 106, the Comprehensive Environmental Response, Compensation, and Liability Act Section 120(h), and DOE Order 458.1, "Radiation Protection of the Public and the Environment." The Department is working towards completing the necessary actions to transfer 1,641 acres to the Community Reuse Organization by September 30, 2015, as required by the National Defense Authorization Act.

Q8. Can you please provide an update on work to provide public access to the summit of Rattlesnake Mountain as required under the 2015 National Defense Authorization Act?

A8. DOE is involved in consultations with the U.S. Fish and Wildlife Service and the Advisory Council on Historic Preservation on this matter. Because the U.S. Fish and Wildlife Service manages significant parts of the Hanford site's Hanford Reach National Monument (including Rattlesnake Mountain), the U.S. Fish and Wildlife Service will serve as the lead Federal agency for implementation of the legislation to provide public access to Rattlesnake Mountain. The Richland Operations Office will continue to be fully engaged and supportive as the consultations proceed.

- Q9. EM sites face the most complex chemical processing and environmental challenges ever addressed. How will you ensure strategic alignment of DOE's federally funded research and development centers with the DOE EM site owners and contractors to balance cost and risk, enable viability of the mission, and provide defensible lifecycle decisions through site-specific technology maturation and analysis?
- A9. The Office of Environmental Management's (EM) Technology Development and Deployment program focuses on resolving technical challenges using science and innovation to develop practical solutions for environmental cleanup in response to the highest priority needs of EM sites. The program provides key investments in mid- and long-range research and development projects focused on developing new cleanup methods where none previously existed, reducing the cost, and accelerating the schedule of high priority cleanup issues. The program addresses issues related to: (1) tank waste, (2) soil and water remediation, (3) nuclear materials management and disposition, and (4) deactivation and decommissioning of contaminated excess facilities including nuclear reactors and chemical separation plants.

These research and development projects are aimed at improving the technical maturity for current baseline technologies and improving or providing next-generation technologies for insertion into program projects, all leading to developing more cost-effective alternative cleanup solutions. In FY 2014, EM enhanced its Technology Development and Deployment efforts with a coordinated two-prong approach where select activities would be managed at Headquarters while others would be managed at the field sites:

- Longer-term activities with low technology readiness levels (high technology risk) are managed at Headquarters and are reflected in this budget chapter.
- Shorter-term activities with higher technology readiness levels (low technology risk) are managed at the sites where the technology will result in direct mission-related benefits.

It is expected that the resulting advances in science and technology will facilitate completing the EM mission more swiftly, more inexpensively, more safely, and more effectively.

- Q10. Cyber security vulnerabilities pose a significant and growing threat to US national and economic security. The magnitude of this threat demands aggressive investments in both basic and applied research, and in innovative ways of deploying cyber security technologies. I just toured the Pacific Northwest National Laboratory and had a chance to learn about the impressive cyber security capabilities there and throughout the National Laboratory system. Given the urgency of the cyber threat, how do you plan to invest the Department's resources to meet this challenge? What is the role of DOE and the National Labs in cyber security?
- A10. The Department of Energy continues to pursue energy sector cybersecurity with strategic near-term, mid-term and long-term investments. The National Laboratories are our strategic partners in each of these stages. Examples of near-term efforts include R&D collaborations with private sector partners, which often engage National Laboratory team members to develop products that have successfully transitioned from the National Laboratories to the private energy sector, and maturity models that the energy sector uses to evaluate their cybersecurity implementation and management practices. Additionally, experts from DOE National Laboratories have trained operational personnel from utilities across the United States in advanced cybersecurity techniques to strengthen the energy sector's ability to detect and respond to cyber-attacks. Mid-term and long-term efforts have likewise benefitted from extensive involvement with the National Laboratories. The overall strategy is best described as long-term research leading to mid-term development that becomes a near-term, commercially available capability applicable to the energy sector. DOE works collaboratively with National Laboratories, universities, and private sector partners, such as suppliers and energy sector asset owners and operators, to remove potential stovepipes and bring together the best expertise to develop cybersecurity capabilities for the energy sector. This approach aligns with the Presidential Policy Directive (PPD)-8 framework of protection and mitigation. It creates cybersecurity technologies that well position energy sector defenders against cyber-attacks. Under this approach, the cyber-defender is not called upon to react as each new threat emerges, but instead works with resilient energy delivery systems that can survive a cyber-incident, sustaining critical functions regardless of the threat.

DOE's investments also maintain core capabilities at the National Laboratories. One example of DOE-supported core capabilities at the National Laboratories is research to

help identify energy delivery system computers and networks that may have been compromised by the insertion of malicious cyber-functionality during transit through the supply chain. DOE also supports research that allows energy delivery control systems to dynamically change configuration, while sustaining critical functions and reconfigure to survive a cyber-attack.

QUESTION FROM REPRESENTATIVE BRUCE WESTERMAN

- Q1. In the FY 2016 budget request, DOE Fossil Research and Development continues to focus R&D on reducing carbon emissions for the use of all fossil fuels.

A U.S. Forest Service study reported that on average over 90 teragrams (approximately 100 million tons) of carbon are released each year through wildfires on public lands alone in the United States with that number projected to increase 50% by 2050 and double by 2100. Properly managed, productive forests are a proven method to improve forest health which reduces carbon emissions from dead and decaying forests, sequester more carbon during the carbon cycle due to the natural, higher biological growth rate of young trees, and promote clean air, clean water, and provide renewable resources to fuel economic growth.

Is the Department of Energy exploring the impact of forest management in its ongoing research on global carbon emissions? Does interagency collaboration with the Department of Interior consider the combined impact of forest management and fossil energy on global emissions?

- A1. USDA and DOI have within their missions the protection and management of federal lands and support to private forestlands. DOE is aware of the issue of high levels of forest fires and has collaborated with both Departments to find uses for biomass as an incentive to remove high levels of forest fire fuels and improve forest resistance to fire and pests, for example through a previous Memorandum of Understanding between DOE, USDA, and DOI for cooperation on the removal and utilization of biomass. DOE is also aware of the important role that land use plays in the carbon cycle. Land cover and land use modeling is an important part of DOE's research funding for integrated assessment modeling. In addition, DOE collaborates with other agencies on land use and land cover modeling through the U.S. Global Change Research Program.

QUESTIONS FROM REPRESENTATIVE ZOE LOFGREN

Q1. Why was Fusion Energy Sciences singled out for cuts in the President's budget? I know you've expressed a commitment to fusion research on prior visits to this committee; are you concerned that if that commitment is not backed by sufficient funds, fusion will never become a reality?

A1. The FY 2016 Congressional request for the Fusion Energy Sciences (FES) program is \$420 million, which represents a small increase over the Administration request of \$416 million for FY 2015. The Department remains committed to investing in fusion energy long term. The budget request for FY 2016 will support a program that has high impact, including world-class large-scale magnetic fusion facilities, vigorous and well-targeted international partnerships that leverage U.S. expertise, leading research in fusion high-performance computing and materials science, and a wide range of innovative university programs in the fusion and plasma sciences that serve the research needs of over 250 students nationwide.

Q2. In 2013 the National Academies released a report which found that several inertial fusion concepts, including the approaches taken by the National Ignition Facility and the Z Pulsed Power Facility, have enough technical promise to justify dedicated federal support for inertial fusion R&D relevant to energy, not just weapons reliability. However, there is currently no program in the federal government which directly, officially supports inertial fusion research and technology development activities for energy production purposes. Further, the Administration is again proposing to eliminate all of the activities in the Fusion Energy Sciences program that could make important contributions to inertial fusion research.

Dr. Holdren defended these cuts by indicating that the Administration would not support any inertial fusion energy R&D activities at all that are not relevant to nuclear weapons reliability unless and until ignition is achieved at NIF, which he believed to also be consistent with a recommendation in the National Academies report. But that recommendation referred to a large program on the level of the magnetic fusion energy research program supported by the Office of Science. Consistent with their prior conclusion, the report authors maintain support for funding a smaller, targeted inertial fusion energy R&D program now which leverages NNSA's investments and fills critical energy-relevant research gaps that are not relevant to NNSA's weapons reliability mission, and therefore will not otherwise be supported.

Do you believe that the Department should address the findings of this report? If so, then how does the Administration plan to establish an inertial fusion energy program, or at least find a way to allow strong, merit-reviewed proposals for inertial fusion energy research to be eligible for federal support?

- A2. The National Academies report recommended that the time to begin an Inertial Fusion Energy (IFE) program is after the demonstration of ignition in the laboratory. While the ongoing research at the National Ignition Facility (NIF) is directed towards stockpile stewardship, this includes a vigorous effort towards achieving ignition. The Department concurs with the report. Inertial Fusion Energy is not an NNSA mission, and given resource constraints in both the NNSA and the DOE Office of Fusion Energy Sciences, resources expended on an IFE program would likely divert from rather than support higher priority efforts to demonstrate a burning plasma.

The science investigations presently supported on NIF, Z, and Omega are relevant to many potential IFE technology pathways, but until ignition is demonstrated it is impossible to know which is the most fruitful research path to pursue.