

DEPARTMENT OF ENERGY SCIENCE
AND TECHNOLOGY PRIORITIES

HEARING
BEFORE THE
COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY
HOUSE OF REPRESENTATIVES
ONE HUNDRED THIRTEENTH CONGRESS
FIRST SESSION

TUESDAY, JUNE 18, 2013

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**DEPARTMENT OF ENERGY SCIENCE
AND TECHNOLOGY PRIORITIES**

TUESDAY, JUNE 18, 2013

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

The Committee met, pursuant to other business, at 10:18 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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Department of Energy Science and Technology Priorities

Tuesday, June 18, 2013
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witness

Dr. Ernest Moniz, *Secretary of Energy, U.S. Department of Energy*

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

HEARING CHARTER

Department of Energy Science and Technology Priorities

Tuesday, June 18, 2013

10:15 a.m. – 12:15 p.m.

2318 Rayburn House Office Building

PURPOSE

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

WITNESS LIST

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

BACKGROUND

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

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

Department of Energy (DOE) Science and Technology Spending
(dollars in millions)

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

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

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

DOE's Fiscal Year (FY) 2014 budget request seeks funding to achieve the Administration's energy policy goals: reducing oil dependency by 2 million barrels a day by 2025 and cutting oil imports in half by 2020; doubling renewable electricity production from wind, solar, and geothermal by 2020; and doubling energy productivity by 2030.² In support of these goals, the request includes investments in the research, development, demonstration, and deployment (RDD&D) of clean energy technologies, as well as investments that lead to a reduction in dependence in oil and mitigate the impact of climate change.³

The overall FY 2014 budget request for DOE is \$28.4 billion, which represents a \$2.1 billion or 6.2 percent increase over FY 2012 levels.⁴ Approximately one third of this amount is dedicated to programs within the Committee on Science, Space, and Technology's jurisdiction. The balance of DOE's funding is primarily allocated to the National Nuclear Security Administration (NNSA), to maintain our stockpile of nuclear materials, and Defense and Non-Defense Environmental Management (EM) programs, to manage the cleanup of nuclear weapons production and government-sponsored nuclear energy research.

DOE R&D PROGRAMS AND OFFICES

Office of Science (SC)

The mission of the Office of Science is the delivery of scientific discoveries, capabilities, and major scientific tools to transform the understanding of nature and to advance the energy, economic, and national security of the United States. The FY 2014 budget request for the Office of Science (SC) is \$5.2 billion, a \$218 million or 4.4 percent increase over the FY 2012 levels. Funding for SC is spread across four priority goal areas: 44% for research; 40% for facility operations; 15% for future facilities; and 1% for workforce development.

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

SC also supports several ongoing interagency initiatives such as the Networking and Information Technology Research and Development program; the National Networking Initiative; the United States Global Change Research Program; and the Climate Change Technology Program. SC provides approximately 45 percent of Federal support of basic research in the physical sciences and key components of the Nation's basic research in biology and high-end computing.

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

³ Ibid.

⁴ Ibid.

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

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

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

Energy Efficiency and Renewable Energy (EERE)

The mission of the Office of Energy Efficiency and Renewable Energy (EERE) is to “strengthen the United States’ energy security, environmental quality, and economic vitality in public-private partnerships.” In FY 2014, EERE requests \$2.8 billion, an increase of \$995 million or 56 percent above FY 2012 levels.

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

EERE programs also emphasize cross-cutting initiatives, including: the EV⁶ Everywhere Grand Challenge, Clean Energy Manufacturing Initiative, SunShot Grand Challenge, EERE Grid Integration Initiative, and Wide Bandgap Semiconductors for Clean Energy Initiative. Specific EERE sub-programs include:

- **Bioenergy Technologies** aims to develop and transform domestic, renewable, and abundant biomass resources into cost-competitive, high performance biofuels, biopower, and bioproducts through targeted planning, research, development and demonstration.

⁶ EV stands for Electric Vehicles

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

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

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

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

ARPA-E was established in 2007 by the America COMPETES Act (P.L. 110-69), and charged with developing energy technologies that result in “(i) reductions of imports of energy from foreign sources; (ii) reductions of energy-related emissions, including greenhouse gases; and (iii) improvement in the energy efficiency of all economic sectors.” The mission of ARPA-E is to support innovations in energy technology that enhance economic and energy security, reduce energy imports, improve energy efficiency, and ensure the U.S. leads in technological innovation. The program focuses exclusively on high-impact innovations that aim to translate science into breakthrough technologies. In FY 2014, ARPA-E requests \$379 million, an increase of \$104 million or 38 percent above FY 2012 levels.

Fossil Energy R&D (FE)

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

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

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

Nuclear Energy (NE)

The primary mission of the Office of Nuclear Energy (NE) is to “advance nuclear power as a resource capable of meeting the Nation’s energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration as appropriate.” NE requests a total of \$735.5 million for FY 2014, a decrease of \$118.4 million or 14 percent below FY 2012 levels.

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

⁸ DOE Budget Highlights, p. 34.

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

Electricity Delivery and Energy Reliability (OE)

The mission of the Office of Electricity Delivery and Energy Reliability (OE) is to "lead national efforts to modernize the electric grid; enhance security and reliability of the energy infrastructure; and facilitate recovery from disruptions to energy supply." Research and Development within OE includes Clean Energy Transmission and Reliability, Smart Grid, Energy Storage, Cybersecurity for Energy Delivery Systems, and the Electricity Systems Hub. Total funding requested for these activities is \$119.4 million, an increase of \$23.2 million or 24.1 percent over FY 2012. OE concentrates R&D activities on addressing potential strains on the electric system as electric generation shifts towards low-carbon energy sources, specifically associated intermittency problems from wind and solar generation.

Loan Guarantee Program Office (LPO)

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

The mission of the LPO is to "accelerate the domestic commercial deployment of innovative and advanced clean energy technologies at a scale meaningful to contribute meaningfully to our national clean energy objectives."⁹ The LPO executes this mission by guaranteeing loans to eligible clean energy projects and providing direct loans to eligible manufacturers of advanced technology vehicles and components. Recipients of DOE loan guarantees include the Caithness Shepherds Flat wind project¹⁰ (the world's largest wind farm), NRG's Agua Caliente solar farm¹¹, a 290 MW commercial-scale photovoltaic solar plant, and Abengoa's Bioenergy Biomass¹², a commercial-scale biofuel plant, among others.

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

⁹ Loan Program Office, Accessible at: <http://lpo.energy.gov/about/our-mission/>

¹⁰ <http://lpo.energy.gov/projects=caithness-shepherds-flat>

¹¹ <http://lpo.energy.gov/projects=agua-caliente>

¹² <http://lpo.energy.gov/projects=abengoa-bioenergy-biomass-of-kansas-llc>

¹³ Ibid, p. 49

Chairman SMITH. The Committee on Science, Space, and Technology will reconvene. Welcome to today's hearing entitled "Department of Energy Science and Technology Priorities." I will recognize myself for an opening statement and then the Ranking Member.

To many, the Department of Energy is typically not regarded as a "science agency," but from its origins with the Manhattan Project to its current programs and mission, science has always served as DOE's foundation.

Approximately \$8.5 billion, or 1/3 of the Department's budget, is focused on civilian science and technology activities that fall under this Committee's jurisdiction. Accordingly, I want to thank our witness, Dr. Ernie Moniz, for joining us today. His presence here continues our tradition of hearing from the DOE Secretary on a regular basis.

Dr. Moniz has a deep knowledge of energy policy, particularly regarding the scientific and technical issues that are the focus of this Committee.

Dr. Moniz's tenure begins at an extraordinary time in our Nation's energy history. We are now just a few years into an energy revolution driven by hydraulic fracturing that has enabled dramatic increases in oil and natural gas production.

The notion of true American energy independence, long dismissed as unrealistic, is now attainable, perhaps even by the end of this decade. These developments will greatly benefit not only our economy but also geopolitics and our national security.

The shale boom has been accompanied by important energy policy debates. These include whether the Federal Government should regulate fracking, whether the Keystone XL pipeline should be built, and how best to handle liquefied natural gas exports. These issues are all of critical importance and all connect to the scientific and technical jurisdiction of this Committee.

Also of major importance is how we prioritize Federal efforts to advance development of alternative forms of energy. In an era of budget constraints, we need to set priorities.

I believe that the best approach is to place a higher priority on fundamental research that will enable new energy technologies to become more cost-effective. This makes sense not only from a fiscal perspective but also from a global perspective. It is widely agreed that any effective solution to climate concerns must be global in nature. And while the United States has reduced carbon emissions in recent years, developing countries have shown little desire for voluntarily switching to more expensive forms of alternative energy.

For example, China and India are expected to build a combined 200 coal plants in the next three years. Global coal use is expected to increase 50 percent by 2035, which will dramatically increase carbon dioxide emissions. This won't change unless alternative forms of energy become more cost-effective. So we should shift from costly subsidies to research and market-driven technological solutions that will be used around the world. To me, this is the only practical, long-term solution.

That concludes my opening statement, and the Ranking Member, Ms. Johnson, is recognized for hers.

[The prepared statement of Mr. Smith follows:]

PREPARED STATEMENT OF CHAIRMAN LAMAR S. SMITH

To many, the Department of Energy (DOE) is typically not regarded as a “science agency.” But from its origins with the Manhattan Project to its current programs and mission, science has always served as DOE’s foundation.

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So, we should shift from costly subsidies to research and market-driven technological solutions that will be used around the world. To me, this is the only practical long term solution.

Ms. JOHNSON. Thank you very much, Mr. Chairman, for holding the hearing today.

And I would like to welcome Secretary Moniz and express my appreciation for his willingness to serve the Nation again, as he has several times before.

Secretary Moniz, you are obviously extraordinarily well-qualified, and I believe that you are the right person to lead the Department of Energy at this critical time.

Let me start by saying that, overall, I am pleased with the Department’s budget request this year. If approved, the Office of Science, ARPA-E, and the Office of Electricity, and the Office of Energy Efficiency and Renewable Energy would all receive a much-needed boost to advance the development of clean energy technologies that will be vital to our national security, our economy, and our environment in the decades to come.

It is worth reminding my colleagues here today that we have seen how government research can pay off when it comes to energy development. DOE-supported research was key to development of

higher-efficiency gas turbines for coal plants, nuclear reactors developed at the Federal labs, and the directional drilling and hydraulic fracturing practices 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 and nuclear energy.

I continue to support research to make today's technologies cleaner and more efficient, but I believe that it is time to level the playing field and introduce real competition to the markets. That is where the priorities set by this budget request come into play.

We have to find the greatest value for our investment of the taxpayers' dollar, and today, it is the emerging energy technologies sectors that will most benefit from our government's support.

I think it is also important to note that DOE's Office of Science is actually the largest supporter of basic research in the physical sciences in the country, and it operates more than 30 national scientific user facilities whose applications go well beyond energy innovation. Our Nation's top researchers from industry, academia, and other Federal agencies use these facilities to examine everything from new materials that will better meet our military needs to new pharmaceuticals that will better treat disease to even examining the fundamental building blocks of the universe.

I believe this stewardship of unique scientific research, including the Nation's major national user facilities is another important role that I hope the Department will continue to make one of its highest priorities.

It is no secret that Congress' inability to date to come to an agreement on a sensible budget plan has led to some devastating cuts to many of these important programs with serious impacts on our Nation's future. I think this budget request is a step in the right direction, and I look forward to working with you, Mr. Secretary, and my colleagues across the aisle to provide you with the direction, the tools, and the resources that you need to get us back on track.

With that, Mr. Chairman, I yield back.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF RANKING MEMBER EDDIE BERNICE JOHNSON

Chairman Smith for holding this hearing today. I would also like to welcome Secretary Moniz and express my appreciation for his willingness to serve the nation again, as he has many times before. Secretary Moniz, you are obviously extraordinarily well-qualified, and I believe you are the right person to lead the Department of Energy at this critical time.

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lieve that it is time to level the playing field and introduce real competition to the markets. That is where the priorities set by this budget request come into play.

We have to find the greatest value for our investment of the taxpayer dollar, and today it is the emerging energy technology sectors that can most benefit from government support.

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It's no secret that Congress's inability to date to come to an agreement on a sensible budget plan has led to some devastating cuts to many of these important programs, with serious impacts to our nation's future. I think this budget request is a step in the right direction, and I look forward to working with you, Secretary Moniz, and my colleagues across the aisle to provide you with the direction, the tools, and the resources you need to get us back on track.

With that I yield back the balance of my time.

Chairman SMITH. Thank you, Ms. Johnson.

Our only witness today is Hon. Ernest Moniz, Secretary of the Department of Energy. Prior to his appointment, Dr. Moniz was a Professor of Physics and Engineering Systems 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 Associate Director for Science in the Office of Science and Technology Policy in the Executive Office of the President.

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

Dr. Moniz, we welcome you today and look forward to your testimony.

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

Secretary MONIZ. Thank you, Mr. Chairman, Ranking Member Johnson, Members of the Committee. I appreciate the opportunity to appear before you today for my first time and in this incarnation and to lay out my vision for the Department of Energy path forward over the next few years. And I certainly look forward to working with this Committee during that time.

I am pleased to be back at the Department. As noted, I served as Under Secretary during the Clinton Administration as well as at OSTP. At MIT, I would just add to the Chairman's description that I also served as head of the Department of Physics and, perhaps of direct relevance here, as Director of the Bates Linear Accelerator Center, which was, at that time, a Department of Energy user facility. So I have seen the Department from that end as well. More recently, I was the founding Director of the MIT Energy Initiative.

So today, again, I will lay out a bit of my vision for how the Department can meet some of the pressing challenges before us and touch on some of the initiatives in the President's Fiscal Year 2014 budget request for the Department.

Clearly, I will start by discussing the science programs, and I want to thank, again, both—actually both the Chairman and the Ranking Member for pointing out the critical role that Department of Energy plays in the science enterprise of this country and also how science and technology really is the thread that runs through all the diverse missions of the Department.

The science programs are crucial to fostering scientific and technological breakthroughs, especially in the physical sciences. The Department provides the national science community with unique research opportunities at major facilities for nuclear and particle physics, for energy science, for materials research and discovery, for large-scale computation, and other disciplines. And the President is committed to making investments in R&D that will grow the economy and enable our country to remain competitive.

A couple of weeks ago I made my first trip as Secretary to Oak Ridge National Laboratory where I saw Titan, then, the world's fastest supercomputer. I was told today that yesterday China has now fielded a machine that is now number one, and I might say this area of large-scale computation, modeling, and simulation, one in which the Department of Energy has helped this country in its leadership role for many, many decades, is fiercely competitive with China, the EU, Japan, others investing large resources, and, in fact, also of interest in China, a stated goal of training 1 million students in the use of high-performance computing for various applications.

While at Oak Ridge, I also visited the Consortium for Advanced Simulation of Light Water Reactors along this theme of large-scale computation. This is the first of MIT—of MIT—of DOE's, excuse me, existing energy innovation hubs. I made that slip because MIT is a partner in that hub.

In its first three years, CASL has already released software that simulates a virtual operating physical reactor. And the President's budget continues support for this and other hubs and proposes a new one in electricity systems following the recent awards to Argonne and Ames for batteries and energy-critical materials respectively.

The President's budget also continues support for DOE's Energy Frontier Research Centers run out of the Basic Energy Sciences office, and these are working to solve specific scientific problems that are barriers to clean energy technology development.

The budget request also supports the continuation of DOE's three Bioenergy Research Centers, which are very successfully pursuing basic research underlying a range of high-risk, high-return biological solutions for energy applications.

Within science, nuclear and particle physics continue to shed light on fundamental properties of matter at the subatomic level. In the nuclear program, we have a robust program operating the Relativistic Heavy Ion Collider, continuing the major upgrade of Jefferson Lab in Virginia, and initiating a new facility at Michigan State.

In particle physics, we clearly have to consider what is going to be our direction, particularly with Fermilab, our flagship facility, right now, pursuing the Intensity Frontier, and this will be an important development over the next three years, how we see the vector for high-energy physics.

Let me turn, if I may, briefly, to energy technology and policy. As the Chairman noted, in the last four years since President Obama took office, the global energy landscape has undergone a profound change. The United States oil and gas production has increased each year, while oil imports have fallen to a 20-year low. At the same time, renewable electricity generation has doubled and should double again in the next several years, and carbon emissions have simultaneously fallen to the lowest level in the United States in nearly two decades.

But even with the increase in domestic oil and gas production, high gasoline prices still impact American families and businesses every day and remind us that we are still too reliant on oil. The President has emphasized there is no silver bullet but we continue to pursue a multipronged approach in terms of efficient vehicles, alternative fuels, and vehicle electrification.

Another important focus, one that I have emphasized quite strongly as well, is that on energy efficiency. The President's goal is to double American energy productivity by 2030, saving consumers and businesses money and increasing competitiveness. Efficiency really is the fifth fuel.

And of course, we will continue our cutting-edge science and technology research R&D to accelerate the transition to a low-carbon economy through cost reduction as the principal goal of innovation.

Given the time, I will just say a few words about moving forward with programs like ARPA-E, which I consider to be a critical part of this country's energy innovation system and also noting how it suggests that we continue to have an enormous amount of untapped innovation capacity that we should try to bring to bear.

Finally, in discussing energy, I will note that I also served on President Obama's Council of Advisors on Science and Technology, PCAST. And PCAST, at the end of 2010, recommended a new process called the Quadrennial Energy Review for weaving together the many strands that must go into a coherent energy policy. This will require much stronger analytical capabilities which will be a focus for me in these years, and I look forward to working with others in the Administration, the Congress, industry, NGOs, and others to advance this new approach to Quadrennial Energy Review.

In concluding, I would just say that in addition to these mission areas—and of course we also have the nuclear security and environmental remediation areas—but I want to say that improving the management and performance of the Department is one of my top priorities as Secretary. I intend to pursue this in at least four areas: better integrating science and energy programs; elevating the focus on management and performance as an enterprise-wide requirement; increasing the analytical capability, as I said, as an essential underpinning for energy technology and policy; and creating clear lines of authority and responsibility for security across the Department.

So in summary, Mr. Chairman, the Department has significant responsibilities that bear on America's economic, energy, environmental, and nuclear security future, and I am fully committed to working with the Congress in search for solutions. I look forward to our discussion.

[The prepared statement of Hon. Moniz follows:]

**Testimony of Secretary Ernest Moniz
U.S. Department of Energy
Before the
House Committee on Science, Space, and Technology
June 18, 2013**

Chairman Smith, Ranking Member Johnson, and Members of the Committee, thank you for the opportunity to appear before you today to lay out my vision for the Department of Energy.

I have had the opportunity to meet with several members of the Committee during my first four weeks on the job and I look forward to meeting with and working with this Committee in the coming weeks, months, and years. Indeed, I look forward to continuing my engagement with members of Congress from both parties and both chambers to constructively illuminate our perspectives on important national challenges and to seek solutions in a collaborative fashion.

I am very pleased to be back at the Department of Energy (DOE), even if some have characterized my return as a “triumph of hope over experience.” I served as DOE Under Secretary during the Clinton Administration, after working as Associate Director for Science of the Office of Science and Technology Policy in the Executive Office of the President. In fact, my experience at the Department was that we could indeed accomplish much and I do have hope and expectations for doing the same in collaboration with Congress.

I have been working on energy, science, and security issues for most of my professional career. I served on the MIT faculty beginning in 1973, including as Head of the Department of Physics and as Director of the William H. Bates Linear Accelerator Center, a DOE facility operated by MIT. Since 2001, when I returned to MIT from DOE, my principal focus has been at the intersection of energy technology and policy, especially on research and education aimed at a future low-carbon economy. I was the Founding Director of the MIT Energy Initiative in 2006, a campus wide initiative that aligns well with President Obama’s “all-of-the-above” approach to our energy future.

The mission of the Department of Energy could not be more urgent or important. From our efforts to find affordable and clean sources of energy, to ensuring the security of our nuclear stockpile, to cleaning up the legacy of the Cold War — our work, which includes advancing the science that underpins these missions, is essential to our prosperity, environment, and security.

Today, I will lay out my vision for how the Department can be best positioned to address these challenges. Given the circumstances and scheduling of this hearing, my presentation is not that of a conventional budget hearing, but I will touch on some of the initiatives in the President’s Fiscal Year 2014 Budget Request for DOE and their relationship to priorities for the next few years. I will organize my remarks by DOE mission area.

Energy Technology and Policy

As already noted, the President advocates an all-of-the-above energy strategy and I am very much in tune with this. As the President said when he announced my nomination, “we can produce more energy and grow our economy while still taking care of our air, water, and climate.”

Since President Obama took office, the global energy landscape has undergone a profound change. In the United States, oil and gas production has increased each year, while oil imports have fallen to a 20 year low. At the same time, renewable electricity generation from wind, solar, and geothermal sources has doubled; and carbon emissions have fallen to the lowest level in the U.S. in nearly two decades. These changes have important implications for our economy, environment, and national security. Already we are seeing the effects of increased U.S. oil and natural gas production on global energy markets.

Even with the increase in domestic oil and gas production and clean energy generation, there is more work to be done. High gasoline prices impact American families and businesses every day and remind us that we are still too reliant on oil as an energy source. As the President has emphasized, there is no quick fix to a challenge that has built up over decades, but the elements of a solution are in place — more efficient vehicles as supported by the President’s CAFE standards; alternative fuels, such as potential increased use of natural gas and development of economic next generation biofuels; and vehicle electrification. Last week, the Department released eGallon, which describes the “fuel cost” for electric vehicles compared to the gasoline price when driving the same distance; the national average cost of fueling a vehicle with electricity is the equivalent of about \$1.14 a gallon compared to a similar vehicle that runs on gasoline. Together, these three advances — efficiency, alternative fuels, and electric vehicles — will reduce fuel costs for American families.

While we have made important progress in domestic production of fossil fuels and we are seeing progress in the small, but rapidly growing, electric vehicle market, we still need to support research into technological breakthroughs that will free us from the volatility of the oil market. An initiative in the FY 2014 President’s Budget is a request for \$2 billion over the next ten years, set aside from Federal oil and gas development revenue, to invest in a new Energy Security Trust that would provide a reliable stream of mandatory funding for R&D on cost-effective transportation alternatives that reduce our dependence on oil. The President’s plan builds on an idea that has bipartisan support from energy experts, retired admirals and generals and CEOs of leading companies; it focuses on one goal: shifting America’s cars and trucks off oil.

The increase in domestic natural gas production over the past five years has helped contribute to market-led reductions in carbon dioxide emissions as well as an expansion of manufacturing and associated job opportunities. The increase in U.S. unconventional oil production, combined with increased vehicle efficiency and biofuels production will continue to reduce American oil imports and our trade deficit.

The increase in domestic natural gas production is expected to continue. This May, the Energy Department announced that it has conditionally authorized the second proposed facility — the

Freeport LNG Terminal on Quintana Island, Texas — to export domestically produced liquefied natural gas (LNG) to countries that do not have a Free Trade Agreement with the United States. And we will expeditiously work through the remaining applications, reviewing each one on a case-by-case basis to ensure that all approvals are in the public interest.

The risks of global climate change threaten the health, security, and prosperity of future generations. DOE must continue to support a robust R&D portfolio of low-carbon options and key enablers: efficiency, renewables, nuclear, carbon capture and sequestration, energy storage, and smart and resilient grids. The President's FY 2014 Budget requests resources to invest in programs that support research, development, and deployment of the energy technologies of the future that will reduce greenhouse gas emissions and increase energy security. These investments will help us double American energy productivity by 2030, double renewable electricity generation again by 2020, cut net oil imports in half by the end of the decade, save consumers and businesses money by reducing energy use, and support groundbreaking research and innovation to safely and responsibly leverage every domestic source of energy. For example the Administration has already committed about \$6 billion to CCS demonstrations, and success of the forthcoming projects will be a critical step toward meeting the President's climate goals.

The President's Budget increases investments in DOE's applied energy programs. These investments include funding for programs designed to help meet the President's goals of investing in the next generation of renewable energy technologies, advanced vehicles and fuels, and energy efficiency measures that reduce energy use in Federal agencies and the industrial and building sectors. Among these efforts are the Department's successful SunShot Initiative, which aims to make solar energy cost-competitive with conventional sources of electrical energy, and cross-cutting initiatives such as the EV Everywhere Grand Challenge, which aims to reduce the overall cost of electric vehicles, and the Clean Energy Manufacturing Initiative. The Clean Energy Manufacturing Initiative focuses on strengthening U.S. competitiveness through both improved manufacturing of clean energy products and increased manufacturing energy productivity more broadly. It will help enable U.S. companies to cut manufacturing costs, enhance the productivity of their investments and workforce, and reduce the life-cycle energy consumption of technologies. DOE is one of five Federal agencies contributing to the DOD-led National Additive Manufacturing Innovation Institute in Youngstown, Ohio, which focuses on additive manufacturing, often referred to as 3D printing, and a DOE solicitation is active for a new clean energy manufacturing innovation institute focused on wide bandgap semiconductors for power electronics.

To encourage increased energy efficiency and a modernized electricity grid, the Department's Race to the Top for Energy Efficiency & Grid Modernization will incentivize states, local governments, co-operatives, and tribes to implement effective policies to cut energy waste and modernize the grid. The President's Budget requests \$200 million in one-time funding for technical assistance and performance-based awards after the policies are implemented and evaluated.

The Race to the Top initiative is an important part of my larger focus on states, tribes, and local governments. States have been out in front with innovative policies that we want to support and, as appropriate, replicate on a national scale when they prove effective. Different regions of our

country have very different energy opportunities and needs, and we need to build from those to a national policy. In this vein, our national labs have unique capabilities and expertise to provide technical assistance to regional partners. I look forward to expanding our cooperation and collaboration with governments, tribal governments, and other partners across the country.

We need to support cutting edge research across the board that will help create the clean energy economy of tomorrow. The President's Fiscal Year 2014 budget also requests continued support for the Advanced Research Projects Agency - Energy (ARPA-E), to support high-impact energy-related research projects with the potential to transform the energy sector.

ARPA-E has invested in roughly 285 high-risk, high-reward research projects that, if successful, could create the foundation for entirely new industries. Seventeen of these projects, which received an initial investment from ARPA-E of approximately \$70 million in total, have attracted over \$450 million in publicly-announced private sector follow-on funding. ARPA-E funded companies and research teams have produced a battery that doubled the energy density of any previous design, successfully engineered microbes that use carbon dioxide and hydrogen to make fuel for cars, and developed a one megawatt silicon carbide transistor the size of a fingernail.

The Loan Programs Office at DOE has been a critical force supporting large-scale clean and renewable energy projects and advanced technology vehicle manufacturing here in America. Building on work of the previous administration, the Department of Energy has made a number of investments to support these innovative technologies. When you are talking about cutting-edge clean energy technologies, not every investment will succeed — but the latest indications show that the Energy Department's portfolio of more than 30 loan projects is delivering big results for the American economy.

The portfolio includes 19 new clean energy power plants that are adding enough solar, wind and geothermal capacity to power a million homes and displace 7 million metric tons of carbon dioxide every year — roughly equal to taking a million cars off the road. And just this month, Tesla Motors repaid the entire remaining balance on a \$465 million loan from the Department of Energy, nine years earlier than required.

An important part of the President's all-of-the-above approach is nuclear energy. Addressing the disposition of used nuclear fuel and high-level radioactive waste is essential to the long-term viability of the industry. I was pleased to be part of the Blue Ribbon Commission on America's Nuclear Future (BRC) and we submitted our findings to Congress and the White House. The BRC report recommended a consent based approach focused on the dual tracks of interim storage and geologic disposal capacity. The Administration has issued a strategy that embraces the core findings of the BRC, but the path forward requires Congressional action. I look forward to working with Congress on expeditiously implementing policies that ensure that our nation can continue to rely on carbon-free nuclear power.

During my time at MIT, I had the pleasure of serving on President Obama's Council of Advisors on Science and Technology (PCAST). At the end of 2010, PCAST issued a report to the President on *Accelerating the Pace of Change in Energy Technologies through an Integrated*

Federal Energy Policy. It specifically recommended an Administration-wide Quadrennial Energy Review (QER) with DOE in the executive secretariat role.

The Quadrennial Technology Review of 2011 was the first installment in the QER process. I plan to build on this foundation by working with colleagues across the Administration, garnering strong input from the Congress and private sector stakeholders, and enhancing the Department's analytical and policy planning capabilities.

Science

DOE's science programs provide the technical underpinnings to accomplish the Department's missions and form part of the backbone of basic research in the physical sciences in the United States. The Department provides the national research community with unique research opportunities at major facilities for nuclear and particle physics, energy science, materials research and discovery, large-scale computation, and other disciplines. More than a hundred Nobel Prizes have resulted from DOE-associated research.

Competing in the new energy economy will require us to harness the expertise of our scientists, engineers, and entrepreneurs. As the President said, "the world is shifting to an innovation economy, and nobody does innovation better than America." The President is committed to making investments in research and development that will grow our economy and enable America to remain competitive, and has requested significant resources to ensure America leads the world in the innovations of the future. The President believes in a robust scientific research infrastructure, strong support for research, and a buildup in human capacity.

Energy Frontier Research Centers (EFRCs) provide an important example of the Department's focus on supporting new and emerging research areas. These centers support scientists and engineers as they work to solve specific scientific problems to help unleash new clean energy technology development. Importantly, the EFRCs followed an outstanding process organized by the previous Administration, engaging about 1,500 scientists from across the country who identified key basic energy science challenges. So far, the EFRCs have generated some 3,400 peer-reviewed papers, 60 invention disclosures, and 200 patents; and the Centers report numerous instances of technology transfer. In their three-plus years of existence, the EFRCs have achieved scientific breakthroughs in multiple areas, from solar power and batteries to new catalysts for refining petroleum and powering fuel cells. In FY 2014, we plan to hold an open re-competition to select new EFRCs and consider renewals of some existing EFRCs. This process is not reinventing the wheel but ensuring that our research dollars are supporting projects with the highest possible impact across the energy landscape.

Earlier this month, I made my first trip as Secretary to Oak Ridge, Tennessee to visit the Oak Ridge National Lab (ORNL) and the Y-12 National Security Complex. During my visit, I toured the Spallation Neutron Source, a facility that is helping us better understand the properties of the advanced materials needed to harness and store energy, and which is just one example of the cutting edge facilities across our national labs that are critical for our economic competitiveness and our national security.

While at ORNL, I also had the opportunity to see Titan, the world's fastest supercomputer and Everest, a state-of-the-art facility for data exploration and visualization. These tools are helping us with a variety of scientific solutions, such as better prediction of climate change today by modeling the climatic changes at the end of the last ice age, 20,000 years ago, to improving the production of biofuels by visualizing how cellulosic plant materials are broken down into sugars.

We have long been the global leaders in supercomputing and DOE and its predecessors have long been key drivers. In 1954 a group of researchers at ORNL created one of the world's first supercomputers — built from vacuum tubes, transistors, and diodes. The Oak Ridge Automatic Computer and Logical Engine helped in the early research of nuclear physics and the biological effects of radiation.

Currently, the U.S. has three of the five most powerful computers in the world, but our global competitors are not far behind. Maintaining a cutting-edge, domestic advanced computing capability, however, is a crucial component to achieving our mission and furthering the science that underpins advances in energy technology, environmental remediation, and nuclear stewardship. This capability requires both advanced hardware and, equally important, the advanced software, algorithms, and operating systems that are optimized to take full advantage of our investments in new machines. These advanced computing capabilities allow us to model complex systems such as the climate and also enable us to analyze and interpret the unprecedented data streams that we are generating through our environmental sensor networks and our world-class scientific facilities. By pursuing the research necessary to enable and build the next-generation of supercomputers, exascale machines with 50-100 times more capability than the current generation, we can help ensure continued U.S. leadership in this important area.

While I was at Oak Ridge, I also visited our Consortium for Advanced Simulation of Light Water Reactors (CASL). CASL is the first of DOE's five existing Energy Innovation Hubs. Through the Hubs, we are bringing together our nation's top scientists and engineers to make game-changing progress in energy technologies. For example, CASL has released software that support simulating a virtual model of an operating physical reactor. I had the pleasure of serving as the first Chairman as CASL's Board of Directors and saw firsthand how the Hub was making a real difference on critical issues for nuclear power. The President's budget continues support for our Hubs and proposes a new Hub in electricity systems.

Nuclear Security

The President, beginning with his speech in Prague in 2009, has laid out a clear vision of nuclear security. This strategy includes step-by-step reductions in nuclear weapons, while ensuring the safety, security and effectiveness of our stockpile as long as we have nuclear weapons; strengthened efforts to prevent the spread of nuclear weapons; and measures to prevent nuclear terrorism. DOE has significant responsibilities spanning much of this agenda.

Last week the Department released its Stockpile Stewardship Management Plan, which lays out the Administration's plan to ensure that our nuclear arsenal remains an effective deterrent so long as we should need it.

The President's Budget requests resources to strengthen our national security with investments in the Department's National Nuclear Security Administration (NNSA) as described in the Administration's Nuclear Posture Review (NPR) of 2010. This funding proposal is the result of an unprecedented cooperative analysis and planning process jointly conducted by NNSA and the Department of Defense. The Budget meets the goals of the NPR by funding cost increases for nuclear weapon life extension programs, such as upgrades to the W76 and B61 nuclear weapons; initiating new upgrades for the W78 and W88 nuclear weapons; improving or replacing aging facilities, such as the Uranium Processing Facility; adding funds for tritium production and plutonium manufacturing and experimentation; and sustaining the existing stockpile by maintaining the underlying science, surveillance, and other support programs.

This national security investment provides a strong basis for transitioning to a smaller yet still safe, secure and effective nuclear stockpile. It also strengthens the science, technology and engineering base of our enterprise.

NNSA plays a vital role in achieving President Obama's other nuclear security objectives, including in the prevention of nuclear terrorism — and the grave and urgent threat it presents to our nation and the world. The Budget requests support for NNSA's efforts to detect, secure, and dispose of dangerous nuclear and radiological material around the world, helping the Department to fulfill its role in completing the President's four-year plan to secure all vulnerable nuclear materials worldwide.

The Department of Energy's enterprise-wide intelligence and counter intelligence capability is also critical to our national defense and nuclear security. And I intend to make sure that these assets continue to sustain our national security.

Environmental Remediation

Environmental remediation at the many sites involved in decades of nuclear weapons production during the Cold War remains a major mission for the Department. This is a legal and moral imperative. DOE has made substantial progress in cleaning up this legacy waste but, as you know, the hardest challenges remain as long-term, expensive, complex projects in several states.

The President's budget requests the resources necessary to support the environmental remediation effort, led by the Office of Environmental Management. I pledge to work with members of Congress, and the affected communities and other stakeholders openly and transparently as we confront the many challenges involved in remediation efforts. As part of that effort, I will renew the Department's emphasis on the management and performance of its major projects.

One of our most challenging Environmental Management projects remains the Hanford Site in Washington. I have committed to a plan to address the serious issues at hand, and I look forward to visiting Hanford tomorrow and determining the path forward on the project.

Management and Performance

The Department of Energy has a broad range of responsibilities that stretch across cutting edge science and technology programs, national security priorities, and complex environmental cleanup projects. Responsibility for taxpayers' money demands that we manage our resources in the most efficient manner possible. Improving the management and performance of the Department is one of my top priorities as Secretary.

I have been carefully reviewing the organization and management practices within the Department and am working with my staff to develop options to reorganize. I see this as a sustained effort for continuous improvement and I look forward to working with members of this committee and others in Congress and the Administration to elevate the focus on management and performance at DOE.

As part of this process, I have identified several areas where I plan to make improvements:

- To better support the President's all-of-the-above energy strategy, we need to improve the Department's systems approach to energy policy analysis. DOE has analysis capabilities housed in each major program area, but to strengthen our integrated policy assessment capability to provide the Secretary, the President, and the Congress with comprehensive assessments of key energy policy issues, I am considering plans to consolidate and strengthen policy and systems analysis, to make better use of existing resources.
- A key factor in successful technology innovation programs is the ability to closely integrate and move quickly from basic science, to applied research, to technology demonstration. The Department has made important strides to foster communication between its science and energy programs, but we must do more organizationally to drive this process. I am considering ways to more closely integrate the management of science and energy programs to improve the dexterity and effectiveness of the innovation process.
- The security breach at the Y-12 facility revealed unacceptable shortcomings in the Department's oversight of its security programs and systems. I plan to revamp the security oversight apparatus, including a stronger independent oversight function that will report directly to the Secretary. A culture of safety and environmental compliance go hand-in-hand with good security, and I believe that all of these functions should be given greater attention
- We need to build consistency and accountability across the entire Department. The various mission support functions of DOE require greater day-to-day oversight, coordination and integration. I am considering means of strengthening the lines of authority and management of these functions.
- Finally, I am examining the organization of the Office of the Secretary. I look forward to building councils of advisors that will provide enterprise-wide advice and analysis on

issues ranging from cyber security to the management of the National Labs. I also plan to engage the Directors of the National Laboratories regarding the Department's mission and to appoint new members to and work closely with the Secretary of Energy Advisory Board. Bringing together these measures to improve internal coordination and reaching out for expert outside advice will provide me with a broader base of information and analysis to make informed decisions.

Conclusion:

In summary, the Department of Energy has significant responsibilities that bear on America's economic, energy, environmental and nuclear security future. I have appreciated the opportunity to collaborate with members of this Committee and with other members of Congress both during my previous tenure at DOE and in the years since. I am committed to working with the Congress in a search for the solutions to the country's energy and nuclear security challenges.

As President Obama has said, "Today, no area holds more promise than our investments in American energy. After years of talking about it, we're finally poised to control our own energy future." The investments included in the Administration's Energy Department budget request are vital to ensuring America's energy security and securing America's place as the world leader in the clean energy economy.

Thank you, and now I am pleased to answer your questions.

Dr. Ernest Moniz - Secretary of Energy

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 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, and Michigan State University.

Chairman SMITH. Thank you, Secretary Moniz.

Let me recognize myself for questions.

And my first one goes to the loan guarantee programs. The Government Accounting Office says that there are eight new loan guarantee programs under consideration at a total cost of about \$2 billion. Is that accurate, and if not, what is the right figure as far as the loan guarantee programs that might be announced, say, this year?

Secretary MONIZ. Well, I am not quite sure what that figure refers to specifically.

Chairman SMITH. Okay.

Secretary MONIZ. But there is the 1703 program, which I think is probably being referred to, the one that has a conditional agreement for a loan for the nuclear reactors in Georgia at about \$8 billion, so that still remains to be seen where that goes. And there is consideration as authorized for developing a potential program in the fossil fuel area.

Chairman SMITH. Okay. And those are the only loan guarantee programs you are aware of that might be under consideration?

Secretary MONIZ. To my knowledge, that is what the—what are being considered. The other area where there is additional authority is in the Advanced Vehicle program, but currently, there is no—

Chairman SMITH. What about alternative forms of energy, wind, solar, and so forth?

Secretary MONIZ. Again, I will go back and check, Mr. Chairman, for sure, but what I am aware of right now that is active is the conditional loan on the nuclear reactors and considerations about a fossil program.

Chairman SMITH. Okay. No imminent announcements on any of these?

Secretary MONIZ. Well, I had better check that to be sure—

Chairman SMITH. Okay.

Secretary MONIZ. —but that is my knowledge of it.

Chairman SMITH. Okay. Fair enough. The other question relating to that is that will the loan guarantee programs put the interest of taxpayers ahead of the interest of others?

Secretary MONIZ. Absolutely. I believe the program has always striven to do that.

Chairman SMITH. Okay. So if the company fails, the taxpayers would be paid back first?

Secretary MONIZ. Well, yes, sir. I mean the overall judgment will be to protect taxpayer dollars.

Chairman SMITH. The reason I ask that was Solyndra, you had the situation that before bankruptcy was actually declared, the loan was restructured and the taxpayers were put second instead of first, but you don't envision that happening again?

Secretary MONIZ. We have no such plans for that—

Chairman SMITH. Okay.

Secretary MONIZ. —but I can guarantee always putting taxpayers' interests—

Chairman SMITH. Great. Thank you.

Let me move on to the subject of climate change and ask you what percentage of climate change do you think is attributable to human activity and what percentage to other causes?

Secretary MONIZ. Well, sir, I wouldn't know how to put a percentage on it but I believe the science is clear that manmade activity—

Chairman SMITH. Right.

Secretary MONIZ. —is a major contributor to the global warming that we are seeing.

Chairman SMITH. Right. Assuming that, though, is there any way to estimate what percent? Is it over half, you know, 50 percent, 75 percent, 90 percent is attributable to human activity or is that not—

Secretary MONIZ. Well, what I would say is that in my scientific view the—what we are seeing is consistent with being driven by manmade activities. Clearly, there are background variabilities—

Chairman SMITH. Would the natural cycles—you have solar influence and so forth—

Secretary MONIZ. Correct, but the—basically, my statement is based on the fact that if one simply looks at the amount of what one knows as one has known for over a century how CO₂ in particular drives global warming through the greenhouse effects, we know how much CO₂ we emit from combustion, and we know how much CO₂ is accumulating in the atmosphere, and we know that time trajectory of those—

Chairman SMITH. Right. But still no way to know what percentage is attributable to human activity?

Secretary MONIZ. Well, I don't know how to make a percentage, but again, I think there is no doubt in my mind that the anthropogenic causes are major—

Chairman SMITH. Okay.

Secretary MONIZ. —probably the major driver of climate change.

Chairman SMITH. Okay. Thank you. And then the last question is this—and this is asking you to speculate and be creative, I guess.

Secretary MONIZ. Uh-oh.

Chairman SMITH. And it is for this reason—suppose we were looking at possible breakthrough technologies that would reduce carbon emissions, and we were looking for breakthroughs that did not involve increase in taxes or subsidies. What are some possible breakthroughs that we might see in the next five to ten years that would allow us to reduce carbon emissions without raising taxes and without subsidies? Do you have any idea on that? I am thinking about batteries or maybe more efficient buildings, things like that, but any other ideas that you might have?

Secretary MONIZ. Well, certainly, in the area of efficiency I think there remains enormous opportunity, and buildings, as you have said, are a major focus area. Seventy percent of electricity goes into our buildings. On the supply side—well, in about ten years we hope to have the first small modular nuclear reactor deployed, which could be the beginning of an interesting new industry for us. Solar energy has come down enormously in cost, and I believe that within ten years we will be surprised at its level of deployment. And very critically, battery as energy storage, which you also mentioned, is critical. Costs have come down very dramatically.

There remains a significant way to go to get what I would call mass-market vehicle technology there. But it has been tremendous progress. In fact, I just mentioned the Tesla as—for example, has dropped its base cost by nearly a factor of two in about 4 years.

Chairman SMITH. Okay. Thank you, Secretary Moniz. And let me apologize to you. I am on another committee that is having an all-day markup that has already begun, so I am going to need to excuse myself. I hope to be back in about an hour. And Dana Rohrabacher, I think, is going to take the Chairmanship. And I will look forward to seeing you later.

Secretary MONIZ. Thank you, Mr. Chairman.

Mr. ROHRABACHER. [Presiding] I finally got it in my hands.

Ms. JOHNSON. This is frightening.

Mr. ROHRABACHER. Well, even with that, you are recognized for your five minutes.

Ms. JOHNSON. Thank you very much. This is a gentleman that I have served on this Committee with now in the 21st year, so I do know him pretty well.

Secretary Moniz, I understand that in your previous job as Director of MIT Energy Initiative you played a major role in examining the impacts of energy development on water use and vice versa, so I am sure you already know that this is a significant issue for my State. And I appreciate your responsiveness to my recent letter to you on the subject.

Can you briefly describe the Department's current activities to address the critical link between energy and water and are there further actions you plan to take in this area, now that you are the boss?

Secretary MONIZ. Thank you, Congresswoman.

The energy-water nexus is clearly one of greatly increased attention, and rightly so, because this is a very, very challenging problem. In fact, it is often not recognized that approximately half of the United States' water withdrawals are just for thermal power plants alone. And, of course, water issues have become very prominent in hydrocarbon production.

So at the Department we have a task force that has been put together on the—on energy and water. They have been developing ideas. There are some collaborations, for example, with EPA and DOI specifically on the water issues with hydrofracking. The issues of addressing lower water use, particularly as drought comes across much of our country, are critical.

I have asked our task force to develop a draft program plan for this fall that would give us an idea what might be a new direction that we could then discuss with the Members and of course in the Administration to see how we might shape a program more forcefully aimed at energy and water.

Ms. JOHNSON. Thank you.

As one of the Nation's most respected physicists, can you briefly describe how greenhouse gas emissions trap heat in Earth's atmosphere?

Secretary MONIZ. Okay. I could use a blackboard then. But, no, I mean, quite briefly, the issue is that incoming sunlight, especially, let's say, in the visible range, obviously we see the sun, so that sunlight comes through to the earth; it is absorbed. It is then

re-radiated as infrared and then certain molecules like carbon dioxide trap that infrared radiation and that creates the greenhouse effect which then leads to warming. And this has been—I might say this has been known since the nineteenth century.

Ms. JOHNSON. What are the major risks to our Nation if we don't reduce our greenhouse gas emissions, and are there any increased risks if we delay action?

Secretary MONIZ. Well, certainly, I think, the risks of global warming are very, very considerable. Of course, this does—it is an issue in the end of I should—of global greenhouse gas emissions. With an increase and continued warming, we will—we are seeing of course already indicators such as the dramatic effects on sea ice, but also I think here in this country we are seeing statistically the expectations written down 20 years ago playing out such as droughts, wildfires, storm intensity increases. Again, one can never assign any specific event to the warming, but statistically, it seems to be there. So—and the problem is it is happening very rapidly compared to historical natural cycles.

Also, I should have talked about sea level rise, which then couples with storms to have storm surges, the kind of thing that we saw with Sandy.

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

Mr. ROHRABACHER. And the Chair now recognizes me.

First of all, welcome aboard.

Secretary MONIZ. Thank you.

Mr. ROHRABACHER. And I am sure we are going to enjoy our kibitzing, as I have enjoyed it with your predecessor as well.

Let's—we are talking about global warming. Let me get this straight. You don't know what the natural production of CO₂ is compared to the human production? Is that what your answer to the Chairman was?

Secretary MONIZ. No, sir, I said to the—I know how much CO₂ we are producing—

Mr. ROHRABACHER. Yes.

Secretary MONIZ. —from anthropogenic causes.

Mr. ROHRABACHER. But you don't know the percentage of what is in the atmosphere is caused by human beings versus the natural production?

Secretary MONIZ. So the amount of CO₂ from anthropogenic sources actually significantly exceeds, in fact, the amount that is not remaining in the atmosphere, as the oceans reabsorb some of it. So actually one could argue that—I mean anthropogenic sources really is a very, very major driver.

Mr. ROHRABACHER. So the ocean doesn't absorb the CO₂ that is produced by man, but it does absorb what is produced by nature, and you don't know—

Secretary MONIZ. No, you can't—

Mr. ROHRABACHER. —how much is produced by nature?

Secretary MONIZ. No, I mean the CO₂ molecule is a CO₂ molecule—

Mr. ROHRABACHER. Correct.

Secretary MONIZ. —and there is a carbon cycle, and in that carbon cycle there is a net—at least today there is a net absorption in the oceans and in the land masses.

Mr. ROHRABACHER. Okay. I would appreciate if you could, when you go back and check—I mean it is surprising you don't have the answer on top of your head exactly what percentage of the CO₂ that we are talking about with greenhouse effect here, what percentage of CO₂ in the atmosphere is caused by human activity and what is caused by a natural activity?

Secretary MONIZ. Again, we know the overall fluxes because—

Mr. ROHRABACHER. But what is it?

Secretary MONIZ. —in the carbon cycle—I would have to go back and really get my numbers straight.

Mr. ROHRABACHER. Okay. All right.

Secretary MONIZ. But—

Mr. ROHRABACHER. Go back and get that.

Secretary MONIZ. The—okay.

Mr. ROHRABACHER. That's fine. Now, let me ask you this. Now, I am from Long Beach State and you are from MIT. But I have—

Secretary MONIZ. Good at basketball.

Mr. ROHRABACHER. But there are other people with credentials, like Richard Lindzen from MIT, who are very skeptical of some of the research that has been going on and have articulated that, yet we have just a few weeks ago, an offshoot of President Obama's reelection campaign listed climate deniers. The only other use of that term is a Holocaust denier. Do you use the term denier for those people who disagree with you on climate science, and do you think that term is appropriate in engaging in a civil discourse over a scientific issue?

Secretary MONIZ. I much prefer a civil discourse and that is what I hope we are engaging in.

Mr. ROHRABACHER. All right. Thank you very much.

Now, I certainly am very pleased to hear your commitment to small modular nuclear reactors. I am rather concerned in the development of those small modular reactors that new technology is being focused on rather than light water technology, which is not new technology. Is there some way we are going to meet that challenge that these new small modular reactors are going to be based on a new concept, which I think is much safer and—to the public by going with—not going with the old light water reactor system?

Secretary MONIZ. Well, of course, the first award that was made, as you know, was for a light water reactor-based system, and that is the one that we anticipate being deployed about—by 2022 or so assuming the licensing goes well, et cetera. And, of course, light water reactors will have an advantage in terms of NRC familiarity with that technology—

Mr. ROHRABACHER. Right.

Secretary MONIZ. —for licensing. In the call that is out now, there will be—I am sure, although I don't actually know this; we are in the middle of it—but it is certainly open to both light water reactor and other technologies.

Mr. ROHRABACHER. Now, let me note that I think if we are going to be moving forward with new technologies, shouldn't that be based on old concepts when—if there are new ones available? And I am looking forward to working with you and seeing that we can try to develop this new type of small modular reactor that is going to serve our purposes decades into the future.

And one last note, one last question is that is we are spending billions of dollars in wind-related research, and this is—I mean across the board here. I think it is \$4 billion in 82 different federal wind-related initiatives. For a small fraction of that cost, there are people who are—this Committee also receives NASA. There are people at NASA who suggest that we might be able to develop a space-based solar system that would again be clean energy coming from space and the—and be able to be unloaded on a grand receiver that is a lot less obtrusive than a refinery, et cetera. Do you have any inclinations toward—or do you know about this concept of space-based solar power and what are your—what is your reaction to it?

Secretary MONIZ. Well, I was certainly aware of the concept, which has been around for quite a long, long time. I have not studied it. The last I knew that it was felt by many at least to be rather impractical in terms of the resource requirements, but I would be happy to look at that again if you think it is an area to look into.

Mr. ROHRABACHER. Yes, I will be looking forward to going through that with you.

And now, Mr. Lipinski.

Mr. LIPINSKI. Thank you, Mr. Chairman.

Thank you, Secretary Moniz, for being here today. I think your confirmation 97 to 0 in the Senate is a great testament to you and your work. We rarely see anything like that up here on Capitol Hill these days, so I think that really shows a great respect for not only the work you do but how you do it.

So the first thing I wanted to bring to your attention is a topic that I raise a lot in this Committee, which is the National Science Foundation's Innovation Corps program. As you may know, the I-Corps program is an entrepreneurial education program developed by serial entrepreneurs in the Silicon Valley teaches scientists how to be entrepreneurial. And, as I am sure that you understand that this is something that does not come naturally or has been taught to a lot of scientists or some of our great researchers out there.

Now, the program is already having an impact because, as we saw three months ago, a team that went through the I-Corps program founded a company called Neon that secured seed funding from a private venture capital group. And the founders of Neon have credited their current market strategy to the lessons that they learned, the connections that they made through the I-Corps program.

In April, I wrote to the Department of Energy about this program and Dr. Holdren has testified before this Committee that the Administration sees a lot of promise in entrepreneurial education programs like I-Corps. I think researchers funded by the Office of Science and other areas of DOE will benefit from participating in this program as well. So this is more of a comment than a question, but I would urge you to take a look at the I-Corps program because I think entrepreneurial education for energy researchers can have a tremendous impact on getting new energy technologies to the market more efficiently.

And that is I think a perfect lead-in to the—

Secretary MONIZ. Thank you.

Mr. LIPINSKI. —what I wanted to address next and ask you about. Argonne National Lab, which is in my district, is the proud home of an energy innovation hub on energy storage and battery technology, as you mentioned in your opening remarks. I supported strongly this application by Argonne and I am very proud of the work that they are doing because I think it has the potential to be transformative both for the transportation sector and for renewable energy.

Now, at the same time, there is more to Argonne than just a battery hub. Resources like the Advanced Photon Source, the Mira supercomputer, and a nuclear energy program, among others, all have worldwide renown.

So I would like to get your ideas, Dr. Moniz, for how the innovation hubs will work moving forward, and along the same lines, how can DOE ensure that the United States maintain the right level of commitment to national laboratories and all their world-leading scientific facilities, as well as the science and energy challenges in close cooperation with the industry?

I think the energy hubs, innovation hubs are fantastic. We also face the challenge of how do we balance this with all of the great work that is being done at these facilities. I wanted to get your views on this.

Secretary MONIZ. Thank you. There are several parts to the question. If I may just make a note that your discussion about storage for both vehicles and grids that actually I sent a letter just this week to Senator Wyden and his request looking—that lays out a schedule for us to develop a plan for grid-scale storage. So that is something you may be interested in as well. I would be happy to share that with you.

With regard to hubs, I personally believe that the hubs are a very important way for the Department to do business. The assembly of multidisciplinary teams of scientists and engineers work across the innovation chain as it fits the mission purpose, and it is something I would like to support strongly. Of course, we have to make sure that they are also being managed well and heading to their goals, and I intend to carry out a review of the existing five hubs to see how we can strengthen them and strengthen future hubs.

I might say that with the national labs—you mentioned the national labs broadly—frankly, I think this is the way the national labs in my view should do more of their business with significant teams focused for an extended time on an important problem. I think that is what the labs can do really uniquely much more easily than a typical university environment.

And I have had the pleasure of now meeting twice with the lab directors, once by video, once in person, and I think they are on the same page as I am and that last statement. And very importantly, I think I have said that I would like to work with the leadership of the labs in a much more strategic way than I think has been the case for some time now. As my friend George Schultz likes to say, when you want people there on the landing, you should have them there on the takeoff, and I want the lab directors up front talking about our strategic directions.

Mr. LIPINSKI. Thank you very much. I think it is important that, you know, we continue on and pursue these innovation hubs, but we can't lose sight of what else is going on at the labs. I thank you very much.

Secretary MONIZ. If I may just add a comment. I have said not only the labs but also the universities where the issue of a lot of smaller groups and single investigators is very, very important. We need to have the right balance.

Mr. LIPINSKI. Thank you. I yield back.

Mr. ROHRBACHER. Thank you, Mr. Lipinski.

And, Mr. Hall?

Mr. HALL. Thank you, Mr. Chairman.

And I thank you and the former Chairman of 15 minutes ago.

And, Secretary Moniz, I thank you for appearing. You appeared before us last week, I believe, to discuss Department of Energy science and technology priorities.

Mr. Secretary, as you are well aware, the process of hydraulic fracturing has revolutionized the energy industry helping really put our country America on the course for becoming the world's largest producer of oil and gas by the end of the decade. I think those may be partially your words. And you have previously and consistently stated that the environmental impacts from fracking are "manageable." I think that is too weak, and I want you to improve on that. And I'm going to try to give you a chance to. And that it "certainly was not clear to you" that there have been major consequences from fracking. That is positive, too, but it is not quite far enough. Can we go a step further? Let me help you.

Last week, you concurred with earlier testimony from former EPA Administrator Lisa Jackson of all people that there had not been a single instance in which fracking has been found to contaminate drinking water. That ought to put to rest whether or not fracking has caused drinking water to be bad, shouldn't it? That ought to be enough.

Secretary MONIZ. Well, sir, I think, as I said last week as well, I mean that—

Mr. HALL. Well, if you don't think it ought to be enough, tell me and I will go on to another paragraph for you.

Secretary MONIZ. Well, again, I think I need to clarify my statement. So what I said is the fracturing process, as far as I know, I know of no incidents. But, as I also said, it is the conventional activities like well completion, cement jobs where there have been problems. Water management on the surface, methane emissions, all of these are manageable in the sense that we know the solutions; we just have to put the solutions in place all the time.

Mr. HALL. They are self-manageable because they are thousands of feet apart, aren't they, normally?

Secretary MONIZ. Well, no, but the real issue is in the penetration to the ground, the well, it is the first 200 feet as opposed to 7,000 feet below in the fracturing.

Mr. HALL. Okay. As you know, in the well-publicized instances, the EPA has claimed that fracking caused drinking water contamination in Pavillion, Wyoming; Parker County, Texas; in Pennsylvania, and all these claims turned out to be unfounded and almost dishonest.

Several experts have appeared before the Committee and confirmed that there had been no evidence or history of hydraulic fracturing affecting usable quality of water. Even Dana, the Chairman right here today, asked the last question of an administration member that came here to testify, left the President's desk to come here and testify, and the last question Dana asked him was do you know of anywhere, anytime in the history of the United States of America that fracking has caused drinking water damage? And his answer was no. Are you aware of that?

Secretary MONIZ. I wasn't aware of that specific answer but it is very consistent with what I have said, yes.

Mr. HALL. And given the EPA's poor track record, how can the Federal Government repair its reputation on fracking?

Now, we could work on that reputation if it had been a different president appointed and elected last year but it wasn't. So we have a president that thinks different to what the president we offered I think would have had on fracking. I think we would have looked into some of the testimony that they came here and gave under oath. And will you work with the EPA to assure "good, objective measurements and analysis" that you have stated are needed? You are going to do that, aren't you? We think you are and we hope you are.

Secretary MONIZ. Well, sir, first, I have to say, I mean, the President in my view has been—is all-of-the-above energy policy and he has been very supportive of the developments of—in—of the gas industry. With regard to EPA—

Mr. HALL. Well, I don't have enough time to go into it with you as to whether or not he has been supportive. I have a very 100 percent different opinion that you have about the President's support of energy.

Secretary MONIZ. Okay. Well, that could be a longer discussion.

Mr. HALL. Yes.

Secretary MONIZ. With regard to the EPA, as I said, clearly, they are the ones responsible for the regulatory arena, but we will certainly be happy to collaborate in technology and analysis. In fact, I mentioned earlier we are collaborating on the water issues involving fracking.

Mr. HALL. Quickly, I want to ask you this: Do you agree that the funding mechanism creating the Royalty Trust Fund is an appropriate way to ensure a dedicated funding stream for unconventional and also deepwater natural gas? Yes or no?

Secretary MONIZ. Well, I think the—

Mr. HALL. Yes or no, please. If you can't say either, why, just tell me you—

Secretary MONIZ. Well, the Administration, as you know, is not supportive of that, but the Energy Security Trust proposed has a very, very similar mechanism.

Mr. HALL. And you are familiar with Section 999? I know you are—

Secretary MONIZ. I am indeed.

Mr. HALL. —according to your background.

Secretary MONIZ. I am indeed.

Mr. HALL. How does Section 999 program fit within an all-of-the-above energy strategy?

Secretary MONIZ. Well, I believe the program executed under 999 has been very effective in looking at R&D and particularly on environmental impacts of unconventional production, ultra deep unconventional, onshore, and also helping with research for small producers.

Mr. HALL. And I close with this: If our Nation wants to move closer to energy independence, shouldn't the Federal Government be pursuing technology solutions to facilitate energy production rather than pursuing regulatory actions that restrict production? I hope you will say yes, and if you don't, why, it is okay. I thank you, and I yield back my time.

Secretary MONIZ. I think we should do both.

Mr. HALL. Okay. And we have great hopes for you to tell us the truth.

Secretary MONIZ. Thank you, sir.

Mr. HALL. And we want to be supportive of you.

Secretary MONIZ. Thank you, sir. And I would be happy to follow up with our longer discussion.

Mr. ROHRABACHER. Thank you, Mr. Secretary.

And now, Ms. Edwards from Maryland.

Ms. EDWARDS. Thank you, Mr. Chairman.

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

Over the couple of years that I have been on this Committee, we have been round and round about climate change. Is there human causes to climate change and what do we do about it? And so I just want to get really clear for the record. Mr. Secretary, do you disagree with any of the scientific conclusions of the vast majority of climate—the climate science community that an increase in CO₂ in the atmosphere leads to a warming of the Earth's surface temperature?

Secretary MONIZ. I certainly agree with that, yes.

Ms. EDWARDS. Thank you.

Secretary MONIZ. Um-hum.

Ms. EDWARDS. And, again, to be clear for our record, we have heard from economists, lobbyists, lawyers, lots of folks, not a lot of climate scientists, but I wonder what your response is to the argument that mankind cannot impact the climate or that several thousand scientists signed a letter indicating that climate change is not real?

Secretary MONIZ. I think there is no dispute in my—as I said earlier, the anthropogenic activity has been a major contributor to the recent global warming.

Ms. EDWARDS. Great. I hope we put that to rest so we don't have to revisit it over and over again in this Committee.

And then I want to ask you about renewables because in Maryland we just incentivized a program for offshore wind capacity, and I wonder how the Department is engaging with the States that have made these commitments to boosting solar, wind, and other renewable energy sources, and if you have a comment, if you will, about—I have a pet peeve about electric vehicles and it is that our Department of Energy and other departments haven't actually worked with local planners and regional planners to develop the kind of infrastructure that we need to fully implement these new technologies.

And then I wonder if you could also comment on the impact—you know, as we see an increase in production of natural gas, the impact on our ability to commit the resources that we need in an environment where a lot of fuel costs are pretty stable and so we don't have the anxiety about energy in the same way, and how that impacts your ability to drive an agenda that is, you know, results in us making the investment in technologies for energy efficiency?

Secretary MONIZ. Thank you. There are several questions there, I think.

Well, first of all, let me say that I think offshore wind is a very important, very important area to pursue. Costs are still significantly too high, but it is a great wind resource and especially if we can push out to deeper waters. And we do have work going on in that area.

Secondly, you mentioned in the context of EVs, but more broadly I have been very clear, I think, in my confirmation process and more recently that one of my goals is to significantly upgrade our interaction with States and localities. In fact, I have—I feel that if you look at our country, different regions have very, very different energy opportunities and needs, and I think we need to do more recognition of that so that we can work with regions and develop the appropriate approaches to a future low-carbon economy.

The third, natural gas and the implications of natural gas, again, I view the natural gas bounty that we have as a real opportunity and a plus. I believe it is an opportunity ultimately for getting that bridge to a low-carbon future.

In fact, one of the things we, I think, have not done enough of is looking at the integration of renewables, wind and solar, with natural gas, which is a good way of balance, but, in the absence of affordable storage so far, a very, very good way of balancing supply and demand.

So, clearly, I mean, the natural gas bounty and low-cost natural gas has very much changed the marketplace, and that is why, in fact, we have lower CO₂ emissions. It is the substitution of gas for coal. It has also revitalized much of our manufacturing sector. So I think the issue is to integrate gas, recognize gas as part of the solution going forward.

In the meantime, what is critical is continuing the investments in innovation because what we have to do, just like gas prices have come down, we have to lower the costs of alternative technologies.

Ms. EDWARDS. All right. Thank you very much.

Mr. Chairman, I yield.

Mr. ROHRABACHER. Thank you.

Mr. Neugebauer?

Mr. NEUGEBAUER. Thank you, Mr. Chairman.

Mr. Secretary, it is good to have you here.

In lobbying for his clean energy agenda, President Obama frequently states that the United States should follow the clean energy examples set by other countries such as Germany and Spain. However, in Germany the cost of electricity has risen nearly 40 percent in the last five years, and electricity prices for industry are 15 percent higher and the average for other countries in Europe—15 percent higher than the other—the average in other European countries.

And just last week, German Chancellor Angela Merkel announced at an energy conference in Berlin that spiraling costs of renewable energy are damaging the country's economic competitiveness and need to be scaled back.

Spain is expected to announce next week cuts between 10 and 20 percent to its subsidies for wind and solar projects. The UK has already trimmed some of the low-energy subsidies. It is now saying that Europe's European Union's target of getting 20 percent of its energy from renewable sources by 2020 was a costly mistake. So what have we learned from the Europeans?

Secretary MONIZ. Well, I think there are certainly some important areas that we can learn from, although clearly, I think the most important thing is what we do here at home in terms of our own energy policy.

But, as one example, you mentioned Germany. I would give two examples from Germany. One is—and they are both driven in a certain sense by their approach to standards. Their building efficiency is certainly extremely good, and that saves them a lot of money, especially when the costs are high for electricity.

Another area where they are frankly much better off than we are is in the so-called soft costs for things like installing solar, 40 percent of our costs. So I think there are lessons we can learn there as well.

Mr. NEUGEBAUER. But, you know, I think one of the issues is we are pursuing an agenda that is really being detrimental in many cases to the consumers of this. And so I think one of the things that we want to be extremely concerned about is making sure that we let the marketplace determine what are the best alternatives and not the government.

I would like now to yield some additional time to the Chair, Mr. Rohrabacher from California. I think he wanted a follow-up question.

Mr. ROHRABACHER. Yes, thank you very much.

Just to note with your earlier statement about the intensity of weather conditions and how that reflects on the overall climate of the Earth, I heard a story about a week or so ago about the ship that they found in the Great Lakes, and it had disappeared, I think, in 1910. Do you remember that?

Secretary MONIZ. No, I do not.

Mr. ROHRABACHER. Okay. It was a big story—

Secretary MONIZ. Um-hum.

Mr. ROHRABACHER. —and that ship sank in 1910 in one of the great storms of 1910, and ships disappeared in Great Lakes and everything else where—

Secretary MONIZ. Um-hum.

Mr. ROHRABACHER. —and it was interesting that we had such a massive storm in 1910 which indicates that we are not now going through massive storms that are any different than massive storms that we had in the past. Roger Pielke, I think is how you pronounce his name—

Secretary MONIZ. Pielke.

Mr. ROHRABACHER. Dr. Pielke, thank you very much—

Secretary MONIZ. Um-hum.

Mr. ROHRABACHER. —head of there at the Colorado State has done a study of the statistics and says, yes, floods have not increased, hurricane frequency in terms of their landfall or intensity have not increased, the tornadoes especially the strongest ones have not increased at least since the 1950s when we had many of these tornadoes, drought has not—drought has actually decreased since the middle of the century, since especially, the 1930s, East Coast storms, there is no trend there, and he said, quite frankly, that this idea that we are now—every time a heavy storm comes through and we get it—you see it on TV for someone to suggest that this is something new, that it is wrong, I mean that we are—we have always had these intense storms. That is part of living on the planet.

Secretary MONIZ. Well, I would certainly agree that we have always had these intense storms. I think—and there is—certainly, here, there is more scientific discussion needed than in some of the other areas, but the issue is many very reputable scientists analyzing the data—

Mr. ROHRABACHER. Right.

Secretary MONIZ. —not tornadoes but more—

Mr. ROHRABACHER. Okay.

Secretary MONIZ. —it is in cyclones because of the water issue. The—that it is the statistics; it is not any individual—

Mr. ROHRABACHER. Right. And you are aware that the—we—my colleague, Ms. Edwards, unfortunately is gone, but when we heard this over and over again, oh, the vast—you know, the overwhelming number of scientists disagree that it is manmade activity that is causing this increase in temperature, which I believe the temperature has stayed steady for 16 years now, long after—

Secretary MONIZ. That is in dispute.

Mr. ROHRABACHER. Okay. All right. But do you think the Russian Academy of Sciences is it to be taken seriously?

Secretary MONIZ. I would not offer an opinion.

Mr. ROHRABACHER. All right. Well, I hope that while you are in your office that the Russian Academy of Sciences is someone that you would be conferring with. They totally reject this theory. And I was just over there recently, spent a day with the scientists over there and talking to them.

And one last thing in terms of wind and the rest of them, people—aren't there a lot of birds that are killed by these windmills as well? I mean I understand more birds are killed by these—by this wind power—this attempt to use wind power than we have polar bears in Alaska or in the Arctic.

Secretary MONIZ. I wouldn't know how to compare that but I must say, if I go back to the—what I tried to emphasize is that where I am coming from is actually much simpler. We know what the radiative forcing of carbon dioxide is and we have known that, again, for—since the 19th century. We know how that translates into average temperature increase. We know that—we know how much CO₂ is emitted from anthropogenic sources. We know how much CO₂ remains in the atmosphere. And this is all consistent with a track that would have us in the multiple degrees centigrade average global warming. The more one goes into localized expectations of consequences, the more scientific debate there is.

Mr. ROHRABACHER. Well, thank you.

Secretary MONIZ. But the macro is just clear by counting.

Mr. ROHRABACHER. Well, with all those charts—you are looking at the charts, do they also juxtapose solar activity like solar flares and solar things that also may have an impact—

Secretary MONIZ. It is a long discussion.

Mr. ROHRABACHER. We will have a long discussion on that.

Mr. Bera.

Mr. BERA. Yes, thank you. And I thank my colleague from California for letting me jump ahead.

Dr. Moniz, thank you for being here today. My questions are simple. You know, the public expects us to address issues and solve problems, so I will ask some simple questions.

Dr. Moniz, do you believe that the climate is changing?

Secretary MONIZ. Yes, I do.

Mr. BERA. Okay. And do you believe that, regardless of percentages, that there are both natural causes of climate change as well as human causes of climate change?

Secretary MONIZ. Certainly.

Mr. BERA. And do you believe that, given the trajectory that we are on, that at some juncture the climate change is going to become irreversible or be very difficult to—

Secretary MONIZ. Well, yes, because basically carbon dioxide stays in the atmosphere for many, many centuries so it is cumulative. And yes, we have kind of set the agenda for decades in advance already.

Mr. BERA. And the longer we delay in dealing with this, the more difficult it will be?

Secretary MONIZ. Correct.

Mr. BERA. So given that and given that all of us agree that you are one of the most qualified scientists, you know, the Senate overwhelmingly confirmed you, do you think our focus should be on those areas that we can actually impact climate change which would be the human causes of climate change?

Secretary MONIZ. Well, yes, I think we should—I think prudence calls for us to take prudent steps today, and I might add that the difference of the—again, the anthropogenic over these last decades is the rapidity with which we are—it is not a natural timescale the way we are increasing CO₂ emissions.

Mr. BERA. Great. So this body can debate percentages, they can debate causes, but we all acknowledge that regardless of the percentage, there is a human factor here that leads to increased CO₂ emissions—

Secretary MONIZ. Well, I certainly—and a very strong one in my opinion.

Mr. BERA. —that impacts our ability. Giving us advice, what recommendations would you like to see this body enact and the Administration enact so we start to slow this down?

Secretary MONIZ. Well, I think certainly from the Department of Energy and for this Committee's jurisdiction I think a key is to really push hard on the science and technology that underpins a transition over time to a low-carbon economy. I mean I think that is the innovation agenda. And, as I have said, I think not all of my

entrepreneurial friends like this, but I think the fundamental goal of this innovation is cost-reduction of these technologies.

Mr. BERA. And—

Secretary MONIZ. So that they will all be marketplace competitive and drive—the policy will be a lot easier with lower costs.

Mr. BERA. And specific recommendations for how we actually reduce the cost, what you would like to see us do?

Secretary MONIZ. Well, I mean, again, the targets I think are across-the-board efficiency. I mean efficiency is where today we still have many opportunities that are at least lifecycle-cost beneficial, whether that is vehicles, buildings of course are an enormous opportunity, industrial processes.

Then, we need to go to low-carbon, carbon-free alternatives in the power sector, which is probably the leading sector for getting carbon out of the sector. We have three options: We have nuclear, we have renewables, and we have carbon capture and sequestration. And I believe we need a multipronged approach on all of these, and that is what, in fact, the President's budget proposes. That is what we are doing.

Mr. BERA. Great. As a scientist myself, a life scientist, certainly this is critical.

Secretary MONIZ. Um-hum.

Mr. BERA. You know, we certainly are seeing the changes that are occurring. Again, the vast majority of the public understands that the climate is changing. The vast majority of the science community understands that the climate is changing. And it is about time that we move past debating percentages and addressing the root cause issue where we can address that root cause issue.

So, you know, we on this Committee look forward to working with you. We look forward to working with the Administration, and we look forward to working with the broader community to start addressing our children's future.

Secretary MONIZ. Yes, thank you.

Mr. BERA. Thank you.

Secretary MONIZ. And, again, as I think you are saying, sir, there is lots of debate in terms of how we address it.

Mr. BERA. Absolutely. But, yes, we can have that debate on how we address it.

Secretary MONIZ. Right.

Mr. BERA. But let's move past the debate of whether the climate is changing or not. We know the climate is changing. And let's focus on those areas where we can have impact and we can actually, you know, ensure our children's future and our grandchildren's future.

Secretary MONIZ. Um-hum.

Mr. BERA. Thank you, and I yield back.

Mr. ROHRABACHER. I thank you very much.

Mr. HULTGREN?

Mr. HULTGREN. Thank you, Chairman.

Thank you, Dr. Moniz. Very good to have you here, and I really am looking forward to working with you and do feel like this is a pivotal time for so many issues dealing with science in particular, and so I just want to say how much I am looking forward to that.

It has not been a secret that I had some strong disagreements with your predecessor and also with the President specifically with funding choices. And it is interesting even the discussion today and I appreciated your comments in your statement that the challenges we face, specifically some climate challenges, are not just our challenges; it is world challenges. And when you look at the impact, much of it is happening beyond our borders.

And questions we have to ask is at what cost? There are things we can do but at what cost? And what other things suffer when we have limited resources? So that is the type of debate we need to be having, and I am looking forward to having that debate with you as well.

I really have been frustrated where I feel like some important scientific work, specifically with our national laboratories, has been undercut under this Administration. And the opportunity to continue that funding and that priority and how it all fits in. I talk about really an ecosystem of science and how our laboratories and our universities and our commitment to STEM education all fit together with ultimately what type of nation are we going to be? Are we going to be an innovative nation, cutting-edge nation? That is what I want to make sure during my time here, whether that is short or long, and I hope to be able to work with you on that in finding areas where we can agree to move that forward.

Secretary MONIZ. Me, too.

Mr. HULTGREN. I do want to start questioning of really asking about DOE stewardship in discovery sciences. As you know, the DOE is responsible for things like particle physics, excuse me. My tongue isn't working today—that are not immediately related to its energy mission but have a long history of successes in improving our understanding of the universe. How will you make sure that we maintain the vitality of these fields and remain among the world leaders in things like high-energy physics at a time when the overwhelming priority of the Department has been on subsidizing existing energy technologies and addressing climate change?

Secretary MONIZ. Well, I believe these, as you call them, discovery sciences are an absolutely critical part of our stewardship. I think the—I mentioned—you mentioned, excuse me, particle physics. This is a place where—and this is also my approach—where frankly I think the community needs to come together and decide what is the next direction?

Clearly, the center of high-energy physics right now is in Geneva, but Fermilab, for example, is emphasizing some precision physics and high-intensity physics. Is that the direction we go?

So, Congressman, I think the community has a so-called Snowmass meeting this summer or—yes, summer, which happens to be in Minneapolis.

Mr. HULTGREN. It is not quite Snowmass.

Secretary MONIZ. But I think that that is a critical meeting because, frankly, I think the particle physics community has not had as clear a strategic plan in the last years as some of the other fields have had.

Mr. HULTGREN. Well, I agree with you, and I really do appreciate what you had said earlier, too, with my colleague from Illinois, Mr. Lipinski, of the work that you are doing of bringing lab directors

together to make sure that we have a strategy, that we are not just floundering. And also there have been times where we have kind of pitted labs against other labs. I don't believe it should ever be that way. It is one of the reasons we started up the National Science and Laboratories Caucus, just to help educate other members of how important these are and how each play an important role.

We need to hold them accountable with the funds they have, but let's make sure that we are committed to them and telling the story among ourselves and to the world of how important this is.

You mentioned—and my time is going to run out, but you mentioned how the focus of physics really has changed and focused on Geneva, and that is part of the discussion we have to have as well is big projects, big science projects and how we are going to do that into the future. I want to have that discussion also and look forward to maybe a time where we can sit down, hopefully, and talk about that.

In my last remaining seconds I do want to switch gears to something else you talked about in your opening statement, and that was recent news from China on the fastest computer coming out of China. I am currently working with several of my colleagues on this Committee on legislation that will reauthorize some of the Department's high-speed computing research programs to push us towards the exascale of computing systems.

With that news out of China, where do you think we—there are opportunities to shift funding at the DOE where we could get more bang for our buck with exascale computing instead of existing expenditures in other areas. And to what extent would you hope to coordinate the activities of the Office of Science with NASA on some of that work?

Secretary MONIZ. That is a very interesting question. First of all, we are well along in putting together an exascale plan that we hope to bring to the Congress shortly. I think, by the way, a key direction for the United States in this kind of international competition is to lower the energy requirements dramatically.

Mr. HULTGREN. I absolutely agree.

Secretary MONIZ. I mean our target is like a 20 megawatt exascale machine and not a gigawatt exascale machine. So that is an example of a very important area.

I think working with NASA could be very interesting. By the way, not only on that as an enabling technology, but another place is robotics. I think where we could have a lot more use of robotics in our difficult nuclear security and cleanup missions, and NASA, of course, is a pioneer there.

Mr. HULTGREN. Good. Well, I wondered if maybe I could get a copy of the bill we are working on to get your thoughts on that, the exascale computing bill that we are going to be presenting here in the next couple of days. And you are right; there are some significant challenges. I know just the Chinese system, I think it has got over three million cores and about 18,000 kilowatts of power, so these are the challenges we are going to have to face to really get to exascale. But I know we can do it but I want to be intentional on that and strategic—

Secretary MONIZ. Right.

Mr. HULTGREN. —whether it is with the labs or whether it is with our computing. So thank you. I will look forward to working with you.

Secretary MONIZ. Thank you.

Mr. HULTGREN. I do hope it is positive. I think this is a pivotal time.

With that, I yield back. Thank you for your generousness with the gavel.

Secretary MONIZ. And if I may just comment, I wasn't aware of this caucus with labs, and I would be happy to meet with that—

Mr. HULTGREN. We would love to have you. It is bipartisan and we are working together across the aisle seeing how this is important and how we really haven't done as good of a job as we should have telling the stories of what our labs have done and continue to do and how important they are. So thank you. I yield back.

Mr. ROHRABACHER. Thank you. And I am going to have to unfortunately give up this gavel and—but Mrs. Lummis, who is the Chairman of the Energy Subcommittee here on Science and Technology, will be taking the Chair, but for—in the meantime, Ms. Bonamici from Oregon will have her time.

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

Thank you, Dr. Moniz, for your testimony today. I am going to ask about three issues: electric vehicles; solar energy, especially domestic manufacturing; and wave energy. And because my time is short, I am going to ask the three questions and then give you time to respond.

I was pleased to see significant increases in the energy efficiency and renewable energy budget proposal, particularly in the area of vehicle technologies. Oregon is a national leader in this area. We have a high number of electric vehicles. In fact, your department recently found that in Oregon the cost to operate an electric vehicle is the equivalent of running on gasoline that costs 96 cents a gallon. I think many of my colleagues would appreciate that in their districts.

So can you describe the Department's plans to replicate this type of success in other communities that don't yet have the same deployment levels as my State of Oregon?

And then secondly, on solar energy, you highlight solar energy as a priority. I am glad to see this reflected in a proposed budget increase. In my district in Oregon we have SolarWorld, employing about 800 people, providing the installation industry with a high-quality product while also supporting domestic manufacturing. But SolarWorld's ability to compete domestically is being threatened. Last year, the International Trade Commission unanimously found that U.S. solar manufacturers had been injured by unfair trade practices.

So will you please discuss the impact of such trade practices, especially on domestic solar manufacturing? And can the Department of Energy do more to support domestic manufacturing?

Finally, Oregon has made a strategic decision to work with the Federal Government to become an international leader in wave energy. Many countries, especially in Europe, have already deployed viable operating electricity-generating projects using the emission-free power of ocean waves and currents and tidal forces. In fact,

the U.K. has spent more than US\$780 million on wave energy R&D over the past decade. I believe it is critical that the United States send a clear signal to the rest of the world that we are a strong competitor in and serious market for this emerging sector.

There is a need for some investment related to development of an offshore testing center, which I of course hope will be in Oregon and wonder does the Department plan to pursue an increase for water and wave power in the Fiscal Year 2015 budget request to Congress?

Thank you very much and please respond in the remaining time.

Secretary MONIZ. Thank you. The—so first on the electric vehicles, let me actually first note that in the 2011 Department of Energy Quadrennial Technology Review, the lead recommendation was to shift emphasis relatively speaking more towards advanced vehicle technologies, and that is reflected now in the Fiscal Year 2014 budget. That Quadrennial Technology Review is in the first step towards the Quadrennial Energy Review that I mentioned earlier, which I hope will have similar consequences on a broader playing field.

In terms of the deployment of electric vehicles, clearly, today, the number of vehicles deployed is modest, but the rate of deployment is actually faster than it was for hybrids at this stage of their deployment. And partly it is because they are really high-performance vehicles, a little bit expensive at the moment, but very, very high performance.

The eGallon you referred to in terms of the operating costs of such a vehicle in your State it was below \$1; the national average is \$1.14. And we have a tool now where somebody can find the price of operating a vehicle the same way they can at the local gas station seeing the price up there.

So the goal here is A) get the capital costs down for the batteries; B) in programs like our Clean Cities and our strengthened emphasis on States and localities that I am bringing in. And I have—I can't say right now but I think we will have—an excellent person will be coming in to head this. She is very, very—been very prominent in state energy issues that we will be looking to help localities in terms of the infrastructure development.

Secondly, on solar, clearly, I mean many, many policy instruments are not in the realm of the Department of Energy, but what I would say is, of course, again, we come back to the cost reduction—

Ms. BONAMICI. Right.

Secretary MONIZ. —not only in the, let's say, a module per se but in the manufacturing processes, very, very important. The President's Manufacturing Initiative, I think, is going to be very important here, advanced materials. The new one that is up for bid right now involves power electronics. That is part of a system for solar. And, again working with the States, we have got to find a way to get the soft costs down—

Ms. BONAMICI. Right.

Secretary MONIZ. —which, right now, are driving things very, very heavily.

On—what was the third? Wave energy, wave and tidal energy, that is a program that I have to say I have not yet gotten to re-

view. I know it is a small program right now. I have received strong encouragement to look at the—what have been called the forgotten renewables beyond wind and solar and that would be waves, micro hydro, geothermal. So we will be looking at that in the Fiscal Year 2015 budget preparation. Clearly, I can't make a commitment on any specific number now.

Ms. BONAMICI. Terrific. Thank you very much. My time has expired. We look forward to working with you—

Secretary MONIZ. Thank you.

Ms. BONAMICI. —and I yield back, Madam Chairwoman.

Mrs. LUMMIS. [Presiding] I thank the gentlelady, and I wish to add my warm welcome to you—

Secretary MONIZ. Thank you.

Mrs. LUMMIS. —Secretary Moniz.

Next, you will be hearing from the gentleman from Indiana, Dr. Bucshon.

Mr. BUCSHON. Thank you. And thanks for being here. A couple of questions that I have about worldwide CO₂ emissions, what percentage of the world CO₂ emissions from a human source come from the United States? Do you have any idea?

Secretary MONIZ. Oh, it is—I would say approaching 20 percent.

Mr. BUCSHON. About 20 percent?

Secretary MONIZ. We are number two after China.

Mr. BUCSHON. Right. Okay. So if we hypothetically eliminated all CO₂ emission in the United States, would that have any effect on the world—on the global atmospheric CO₂ situation?

Secretary MONIZ. Well, I—it certainly would because I believe it would be in the context of others doing the same.

Mr. BUCSHON. Okay. And you think—what is the likelihood, you think, that others would do the same as some of the things that are being proposed?

Secretary MONIZ. Well, I think, you know, I am cautious about speculating. I think what we need to do is to take care of our business, lower the costs of low-carbon technologies and create industries, hopefully, that can be profitable in selling to the world as the world goes to low-carbon. So I think we have plenty of incentives, but clearly, in the end, we need to bring along all the major emitters.

Mr. BUCSHON. Right. And so the question I have, I mean, first of all, I do believe the climate in the world is changing; I am just very skeptical about the role of human CO₂ production in that based on historical climate change over the course of the history of the world. And so do you think that the United States should economically disadvantage itself with that end goal when it is pretty clear to me that it is very unlikely the rest of the world will do what you are proposing to do?

Secretary MONIZ. I think we should advantage ourselves and then we may have a discussion about what it means—

Mr. BUCSHON. Sure.

Secretary MONIZ. —to advantage ourselves today, ten years from now, 30 years from now. The energy scene, no matter what the drivers are, is not going to look the same as it does today, and I think we need to have a robust—

Mr. BUCSHON. Now, is that your opinion or do you have—how do you know that that—

Secretary MONIZ. That is my opinion.

Mr. BUCSHON. That is your opinion? Okay.

Secretary MONIZ. And I would say, sir, if I may that—

Mr. BUCSHON. Yes.

Secretary MONIZ. —I think when we look back in time ten years, 20 years, we are always amazed at how the world looks so different. But when we look forward, we tend to think it is going to look just the same.

Mr. BUCSHON. Yes, can I talk about Germany right now? What is Germany doing with their energy production? What is—currently, I mean what are they doing, for example? Do you have any idea?

Secretary MONIZ. Germany has—of course, one thing is they are phasing out their nuclear power.

Mr. BUCSHON. Right, which is what you are proposing that we use as a different source in the United States. So they are—why are they phasing that out?

Secretary MONIZ. In my view it is their decision—

Mr. BUCSHON. And what are they phasing in?

Secretary MONIZ. The issue is what they phase in, exactly.

Mr. BUCSHON. Yes, they are phasing in coal-fired power plants—

Secretary MONIZ. And right now—

Mr. BUCSHON. Is that true or not true?

Secretary MONIZ. There is some additional coal and a lot of additional gas.

Mr. BUCSHON. Okay.

Secretary MONIZ. Yes.

Mr. BUCSHON. Do you know—

Secretary MONIZ. I am sorry. And wind also.

Mr. BUCSHON. Yes, I understand.

Secretary MONIZ. Yes.

Mr. BUCSHON. Do you know—have any idea where venture capital is going when it comes to renewable energy sources? Do you know private investment, venture capital, because what they are doing as it relates to wind and solar right now, do you have any idea?

Secretary MONIZ. Well, I think it has come down a bit from the peak but it is still a pretty large—

Mr. BUCSHON. And why would that—why wouldn't then—why would private sector venture capital be leaving renewables? And I am not saying I am against renewables because I am for everything, okay—

Secretary MONIZ. Well—

Mr. BUCSHON. —but why would that be?

Secretary MONIZ. Well, I don't know in detail. I mean, certainly, one of the reasons has been the large uncertainties in the wind case around the tax.

Mr. BUCSHON. And you would have to—you may or may not agree that it is because that at this point in our history, they are not economically viable and—without the Federal—massive Fed-

eral Government infusion of cash into those industries, is that true or not true?

Secretary MONIZ. Wind certainly in many cases is competitive. In fact, earlier, the gentleman from Texas raised an issue. Well, just recently, our site—DOE's site Pantex signed a fixed power purchase agreement with Siemens from a wind farm and they are saving \$30 million.

Mr. BUCSHON. Okay. My point is—

Secretary MONIZ. I believe it is competitive.

Mr. BUCSHON. I think that—you know, I—from an R&D standpoint, I would probably—you and I would probably agree that continued R&D in these areas is critically important going forward.

Secretary MONIZ. Um-hum.

Mr. BUCSHON. The question is are we getting ahead of ourselves by—at this point without R&D showing that these are economically viable, getting ahead of ourselves essentially? When venture capital is leaving those areas of our economy, should the Federal Government, other than R&D in those areas, continue to put this kind of money into those when it is clear that the private sector and venture capital are leaving them because they are not economically viable? That is the bottom line.

Secretary MONIZ. Well, as I have said, we clearly agree on the R&D. But, today, costs are dropping and in many instances are already competitive. That is not a universal statement but in many instances competitive. That is both wind; the Pantex example is one; and solar, particularly when solar is helping to shave piece at times of large—

Mr. BUCSHON. My time is expired. Thank you very much.

Mrs. LUMMIS. I thank the gentleman.

And now, you will have some questions from the Ranking Member of the Energy Subcommittee, the gentleman from California, Mr. Swalwell.

Mr. SWALWELL. Thank you, Chairman Lummis.

And welcome, Dr. Moniz. I am actually very glad you are here because I had a town hall in my district on Saturday back in the Bay Area of California, and a number of my constituents could not believe that in this Committee some of my friends on the other side still have questions and deny that humans play a role in climate change.

So their questions here today that illustrate that I am not crazy, that that is still a debate in this Committee. And I put up for you on the screen something from the NASA website called "Climate Change: How Do We Know?" And there is a graph there of CO₂ parts per million on the left side of the graph and on the bottom side you see over the period of time starting at about 400,000 years ago going up to about 25,000 years ago, you see a spike. And then, of course, it really spikes around where 1,700 would be. And I am wondering is there any correlation between the industrial revolution and the CO₂ parts per million in that graph?

Secretary MONIZ. Well, it is quite direct actually.

Mr. SWALWELL. And what is the correlation, Dr. Moniz?

Secretary MONIZ. It is a very positive correlation.

Mr. SWALWELL. And what can we assume the cause of the CO₂ parts per million going up?

Secretary MONIZ. Well, this is exactly what I was referring to earlier in terms of, roughly speaking, counting CO₂ molecules. We know how many molecules are emitted. We know how many were in the atmosphere. It tracks quite closely.

Mr. SWALWELL. And, Dr. Moniz, do 97 percent of scientists—climate scientists agree that climate warming trends over the past century are very likely due to human activities?

Secretary MONIZ. Yes, I have seen 97, 98 percent, those numbers, yes. Um-hum. I am not sure how that number is arrived at, but yes. Um-hum.

Mr. SWALWELL. Thank you. And, Dr. Moniz, are you familiar with the National Ignition Facility at Lawrence Livermore laboratory?

Secretary MONIZ. Yes, in general terms. I have not had yet the chance to drill down into it since I have been in the office the last 3 weeks but—

Mr. SWALWELL. Well, better than drill down I would like to invite you to come visit the facility. It is in my district. It is also in wine country so after the tour we would be happy to show you around.

Secretary MONIZ. Before the tour?

Mr. SWALWELL. Do you support the National Ignition Facility's dual goal of maintaining our nuclear weapons stockpile and providing scientists with the physics understanding necessary to create fusion ignition and energy gain for future energy production?

Secretary MONIZ. Well, I mean, I have to say I think clearly the principal purpose of the facility has been for stockpile stewardship, and even without ignition, which remains a goal for a few years from now, presumably, that has to be the major focus. Now, clearly, a lot of that work certainly getting to ignition will, by definition, be useful for the ICF purpose.

Mr. SWALWELL. And you mentioned that just this past week Oak Ridge's supercomputer is no longer the world's fastest, a mantle once again claimed by China. Does it trouble you that Russia and China are also beginning to outpace us when it comes to fusion ignition projects?

Secretary MONIZ. Well, I think it is more of an across-the-board issue. I think, you know, we are in a different world, highly competitive in terms of technology innovation, and we have just got to keep out in front.

Mr. SWALWELL. Would you agree, then, that the President's Fiscal Year 2014 budget request for the National Ignition Facility, a cut of \$110 million, will set us back in achieving ignition and will cede of leadership in the area of fusion ignition to Russia and China?

Secretary MONIZ. Well, clearly, there were lots of difficult choices that needed to be made, and the Department of Defense, with the Department of Energy and OMB, just felt that the needs in stockpile stewardship and stockpile reliability just had to be met in a very tough budget environment.

Mr. SWALWELL. And, Dr. Moniz, the Lawrence Livermore National Lab Director has told me and Congresswoman Lofgren, who has also been an advocate and champion for fusion ignition, that if the President's budget for NIF stands, it will essentially either shut down NIF or set back all of its major goals by at least ten

years. Since NIF began operating in 2009, they were a factor of 1,000 away from achieving ignition. Today, they are a factor of 10 away, which would be equivalent of taking a road trip from Denver, driving to San Francisco, and then when you get to Oakland deciding to stop and turn around and go back to Denver.

So my question is will you let NIF shut down on your watch or will we see it continue to march forward toward ignition?

Secretary MONIZ. Well, I will have to talk with Mr. Albright about that statement. Certainly, the intent is to have NIF—we need it strongly engaged certainly in our Stockpile Stewardship Program.

Mr. SWALWELL. Great. Thank you, Dr. Moniz. And thank you for interpreting that graph on the fly without any warning ahead of time. I appreciate it.

Secretary MONIZ. Thank you. Right.

Mr. SWALWELL. And I yield back the balance of my time. Thank you, Chair Lummis.

Mrs. LUMMIS. I thank the gentleman and the Ranking Member, and I hope that you will include us on this tour that you were discussing with the Secretary.

Next is the gentleman from Arizona, Mr. Schweikert.

Mr. SCHWEIKERT. Madam Chairwoman, is it the tour or the wine country part?

Mrs. LUMMIS. The former and the latter—

Mr. SCHWEIKERT. Yes, yes.

Mrs. LUMMIS. —yes.

Secretary MONIZ. You know, it is an incredible machine.

Mr. SCHWEIKERT. Mr. Secretary, first off, congratulations. You have actually one of the positions in government that, on a personal basis, I find absolutely fascinating because of the things you get to touch and influence. But you have actually seen some of the nature of the conversation here today, and I come with you—at you from a certain philosophy saying, you know, the arrogance of really smart people sometimes we think we know more than we do.

If I were to hop in the literature right now and go back a dozen years ago, whether it be you or many of the smart people who you hang around with, what would you have written about peak oil? The fact of the matter is the next incremental barrel of oil, you know, much of the literature in the very late '90s, very early 2000 made it very clear that the next incremental barrel of oil or fossil fuels would be less.

Small problem is we got it wrong. And we built tax codes here, we built environmental codes, we built regulatory codes, actually even foreign policy based on a premise that was absolutely wrong. I have been very pleased on a couple of your comments saying you are going to try to focus policy on a broad optionality—

Secretary MONIZ. Um-hum.

Mr. SCHWEIKERT. —because the arrogance that you and I know what tomorrow is is the great fault around here. And I know this is starting to sound more like a speech and I don't mean it to. 2007 around here we all knew that compact fluorescent bulbs were the future except for the fact they are not. As of, what was it, December LEDs crashed in price and now I can do LEDs for less money

than compact fluorescent. But we had the arrogance that we all knew what the future was.

Can I beg of you, as you are doing your policy sets, as you visit with policymakers here, to maximize that discussion? I know you come from a physics background, which is often very linear in thinking and saying, policy-wise, who knows what is being developed in someone's garage right now that you and I have never thought of that is tomorrow's manufacturing technology breakthrough. Can I beg of you with this position you have in the next couple years you will maximize that optionality for the next great breakthrough?

Secretary MONIZ. Sir, that is exactly along the lines of what I was trying to emphasize that I think we don't know the future. We always think of the future, again, as a linear extrapolation of the present, and it is not. And it is those innovations that do so much to change the future.

I will just say one thing, however, in terms of peak oil. I have witnesses; I was never a peak oil believer.

Mr. SCHWEIKERT. You will be happy to know, I really couldn't—I Googled you and I did not see you pop up. I did see the guys just down the hallway from you at MIT writing huge articles about how, right now, we should be about \$200 barrel in oil as of this month.

Secretary MONIZ. Well—

Mr. SCHWEIKERT. We didn't even get close.

Secretary MONIZ. —certainly predicting oil prices is a loser's game—

Mr. SCHWEIKERT. Yes.

Secretary MONIZ. —but on peak oil, I mean, our view was always that—

Mr. SCHWEIKERT. But it is—

Secretary MONIZ. —it is not molecules you run out of; it is at what cost can you get the molecules?

Mr. SCHWEIKERT. But you have to agree it is a brilliant example of technology is faster-moving and smarter than we are because someone out there is coming up with it. It is—you know, when I hold up the book of—you know, the Population Bomb—

Secretary MONIZ. Right.

Mr. SCHWEIKERT. —from 1968, the only thing they got right was the author's name. Everything in the book got wrong because the arrogance of not knowing what the next breakthrough is.

Secretary MONIZ. And also just to reinforce your point, in natural gas, of course, it was—

Mr. SCHWEIKERT. Yes.

Secretary MONIZ. —very recently when major heads of major corporations not only got it wrong—

Mr. SCHWEIKERT. Yes.

Secretary MONIZ. —but put their money in the wrong place.

Mr. SCHWEIKERT. Well, yes, but that should be in markets. Look—

Secretary MONIZ. Right.

Mr. SCHWEIKERT. —for just a bit of fun trivia before I bounce on my next really important thing, what is the only major industri-

alized country not to sign the Kyoto Accords? What is the only major industrialized country to actually hit its allocation?

Secretary MONIZ. Um-hum. Well—

Mr. SCHWEIKERT. Because we did not overregulate natural gas, we had massive adoption because we didn't stop it. And all of a sudden, we have had our Kyoto Accords because of market pressures driving us there, not a command-and-control regulatory environment.

There is one thing I will do very quickly. You actually have a lot of regulatory authority within your agency over things like showerheads. Believe it or not, I have a little constituent in my district that manufacturers froufrou showerheads. He had enforcement officers from the Department of Energy walk in his door, hit him with a \$470,000 fine because the flow restrictor took too little pounds of pressure—and I hope I am describing that correctly—to yank out.

Please be somewhat circumspect on the law enforcement functions you have within your agency and how they affect small businesses and our communities and our manufacturer. It is one thing to say you need to change the pounds of pressure to remove the flow restrictor; it is another thing to walk in and hit someone and scare the out of them, you know, with a \$470,000 fine. And with that—

Secretary MONIZ. Okay.

Mr. SCHWEIKERT. —I yield back.

Mrs. LUMMIS. I thank the gentleman, and the gentleman from California, Mr. Takano, is next.

Mr. TAKANO. I thank the Chairwoman, Mrs. Lummis.

Thank you, Secretary Moniz, for your testimony before the Committee this morning.

I was thinking about a joke I could make about 90 percent of the scientists and how my side of the aisle stands with the 98 percent versus the two percent alluding to our economy and 98 percent of the population versus the two percent, but I am not going to go there even though I just went there.

Anyway, I am fortunate to have UC Riverside, a top-notch university research facility. I frequently hear from my constituents and researchers at the university about the key role that the Department of Energy plays in fostering innovation and funding basic research. Since 2009, UC Riverside has received more than \$20 million from the Department to fund research ranging from high-energy physics to the hormonal regulation of plant growth.

This fall, the university plans to open an experimental solar and battery smart grid, the largest at any university in the Nation. The smart grid research lab will allow researchers to study innovative ways to improve smart grid power management, link large computing data centers with the grid, study smart grid cyber security, and better understand ways to link energy from renewable sources with the grid. And that is just a snapshot of the work being done at UCR.

DOE funding has also contributed to biofuels research and solar energy research at Bourns College of Engineering, which is part of the leading edge of research in pushing down on the costs and driving up the efficiency of solar energy collection. This kind of re-

search and innovation not only creates jobs; it leads to the scientific breakthroughs that will allow us to face the challenges of the 21st century. And I appreciate hearing from you today about the Department's strategy as we work together to meet those challenges.

Now, just to be clear, we—you, I believe, counsel moving forward with the best scientific knowledge that we have. I realize I want to be humble and not presume that we know the future, but 98 percent—or 97 percent of the scientists do seem to have a consensus that global climate change is real, that the carbon contribution is coming from human sources, and I don't want to keep beating that drum, but I think we have amply made that point.

I want to go to one of my priorities as a former K–12 teacher—STEM education. I believe you mentioned that the Chinese have a goal of educating one million students in the high-performance computing?

Secretary MONIZ. High-performance computing, yes, um-hum.

Mr. TAKANO. Can you tell me the significance of that goal and do you think it is a prudent goal of the Chinese and what does that pose as a challenge to us as Americans?

Secretary MONIZ. Well, I don't—I can't judge whether it is prudent or not in China, but it does catch my attention in terms of the importance of training scientists and engineers and mathematicians, et cetera, for the—for our future.

And another issue, in fact, I would raise is that I think we need still, after many years of working at it, to do a better job in terms of using all of our talent. Women and minorities certainly in the energy field, we are not as well represented as we need to be. So I think we need to just keep our eye on the ball. Human resources are the key in the end. We have got to use all of our human resources. And it is something that I certainly would like to work on in the next few years.

Mr. TAKANO. I recently ran into a high school classmate of mine who was one of the, I don't know, innovators in terms of all of these games that people play on the Internet.

Secretary MONIZ. Um-hum. Um-hum.

Mr. TAKANO. He was taken with this idea—this 1 million students caught my attention because he really thinks it would be beneficial if we started as early as prekindergarten to teach students the fundamentals of code writing. What do you think about that? Is that something—

Secretary MONIZ. I think I am not qualified to judge on that, but clearly, science, mathematics, and computer literacy are just clearly essential skills I think for young people to succeed in the future. Well, I mean, they can succeed in other things, too, but as a country we need more students succeeding in those areas.

Mr. TAKANO. So—

Secretary MONIZ. And I may just add, one of the things that I have talked about that I would like to look at as a Department kind of along these lines is I think that we may want to look and come to the Congress for discussions at what I would call a traineeship program where we support—so it is not broad necessarily like scholarships; it is focus on areas of national need where we aren't producing enough young people for our missions.

So, for example, in our nuclear security mission, you know, actinide chemistry; for our energy mission, power electronics. So I think that is something that would be a good discussion to have with this Committee and other members about mission areas for the Department, targeted programs to get more people trained.

Mr. TAKANO. This has to be with workforce. But, Madam Chair, my time is up. I am sorry I went over.

Mrs. LUMMIS. I thank the gentleman and yield to the gentleman from North Dakota, Mr. Cramer.

Mr. CRAMER. Thank you, Madam Chair, and Madam Ranking Member.

And thank you, Mr. Secretary, for being with us and being so generous with your time.

I—rather than beating the dead horse, I am going to accept it for a moment. And I was—appreciated a couple of things you said. You referred to three priorities of how to deal with or how to push science and technology investment in the—toward a low-carbon economy. You mentioned nuclear, you mentioned renewables, and the third thing you mentioned was carbon capture and sequestration, and I don't think we have spent any time specifically on that today as a priority, and I would like to explore that.

Coming from North Dakota where we enjoy the lowest electricity prices in the country due to the low cost of coal and the fact that we burn it right there and generate electricity and the fact that we enjoy a good economy as a result of the very high price of oil, I want to talk about the Department's strategy in terms of investment in capturing carbon and using it and injecting it into oilfields for enhanced oil recovery. Your commitment to that, what do you see as that—in—as a possible future scientifically and in research and development in that arena?

Secretary MONIZ. Thank you. Actually, I would say that—in fact, I think two years ago when I was at MIT with the University of Texas at Austin we had a workshop specifically on CO₂ for enhanced oil recovery. Maybe for others not as familiar, I might just say that, today, it is not a widely known story that we are using today 60 million tons of CO₂ annually to produce 300,000 barrels of oil per day from enhanced oil recovery.

And, you know, it is a little bit shaky, but an analysis done for the Department two years ago indicates there may be a factor of 10 still to be had. That would be three million barrels of oil per day. But to have enough CO₂, we need to capture it from power plants or industrial facilities. Today, largely using the stimulus funds of several billion dollars went into the—I think we have now 6 major projects moving forward on carbon capture and storage, and I believe—I can check the exact numbers, but I believe four of those will use enhanced oil recovery.

Mr. CRAMER. Um-hum.

Secretary MONIZ. So, clearly, getting the economic value of the oil helps you with the cost of capturing the carbon.

Mr. CRAMER. Precisely. One of those projects is called the Plains CO₂ Reduction Partnership in North Dakota at the University of North Dakota—

Secretary MONIZ. Yes, head of one of the regional partnerships.

Mr. CRAMER. Yes, that is exactly correct.

Secretary MONIZ. Yes.

Mr. CRAMER. And so I guess I want to use the opportunity to encourage you to continue that investment there because we really—first of all, geologically, there are lots of opportunities obviously—

Secretary MONIZ. Um-hum.

Mr. CRAMER. And when you have eight billion or more barrels of recoverable oil at current technology like we have in North Dakota and an 800-year supply of coal that we would like to burn for a very long time and generate low-cost electricity, if we could find this opportunity to capture that CO₂, which we know—understand is a challenge and yet we do it. We do it quite effectively up to 50 percent of it in our coal gasification facility at least. I would encourage that type of an investment where there is already proven—a proven cost-benefit and, as you said, of the potential for much, much greater.

One other area of—

Secretary MONIZ. Could I just interject?

Mr. CRAMER. Yes, please. Please do.

Secretary MONIZ. And of course the Great Plains plant you referred to was an old DOE investment.

Mr. CRAMER. It certainly was, and boy, what a history it has. Thank you.

One other area I just want to pursue since we—since I have the time is that you have been quite specific about your plans for dealing with LNG export and approving applications for LNG ports on a case-by-case basis, which seems prudent. But realizing that there are a number of applications in front of you where the comment period has ended and some have been waiting for months, is there any chance of expediting some of that in a responsible way? Given the demand in the world and the fact that global markets are—you know, kind of present this window of opportunity for us as a country, could you just comment a little bit on that? I realize it is a little outside the scope, perhaps, of science—

Secretary MONIZ. Well, that is fundamentally my plan. Of course, the second license was granted shortly before I became Secretary. As I said in my confirmation process, I need a few weeks to—and I am still just three weeks—basically a few weeks to go over the process, look at the inputs, et cetera, not commissioning new studies or anything.

I think, you know, we are getting kind of to the place where I think this kind of review—my personal review period is maturing and then I plan to go expeditiously as I have committed.

I understand some of the frustrations and some of the market opportunities, and we also realize that even with a conditional license granted, of course, there is still a lot of work that companies have to do in terms of assembling the capital, getting the customers, getting the suppliers all lined up. So I want to move expeditiously. I have certainly committed to having strong review process this year.

Mr. CRAMER. Thank you for your access today and your willingness to be so frank with us. I appreciate it. Thank you. My time is obviously expired.

Mrs. LUMMIS. I thank the gentleman and yield to the gentleman from Washington, Mr. Kilmer.

Mr. KILMER. Thank you, Madam Chair. And thank you, Mr. Secretary, for joining us today.

The Administration recently announced its proposal to create a national network for manufacturing innovation meant to serve as regional hubs for accelerating the development of manufacturing new innovative technologies. The Department of Energy, through its Advanced Manufacturing Office, has played a direct role in supporting these innovative manufacturing initiatives.

I have certainly found that when most people think about innovation, they tend to think of Mr. Swalwell's district or Silicon Valley, but even in more rural areas, including my neck of the woods on the Olympic Peninsula of Washington State, we have advanced composite materials manufacturers that are developing very high-end, high-quality materials that have enormous potential.

I was hoping you could speak a little bit about what steps the Department is taking to ensure that fair consideration is given to innovation that is taking place in rural areas where the injection of key support could not only help support our long-term global competitiveness but could really revolutionize local economies?

Secretary MONIZ. Thank you. As you say, the Department is a participant along with other agencies in the Advanced Manufacturing Initiative, and had we partnered with DOD and I think a third agency in the 3-D Printing Manufacturing Initiative. And we have one out now in large bandgap semiconductors.

I can certainly assure you that, first of all, proposals will certainly be evaluated fairly from rural areas or others; number two, that my emphasis on doing more with the States I think that lead to a very interesting dialogue about what we can do with—maybe to stimulate additional activity in rural places.

Like I say, today, I would be delighted to have that dialogue, and if you have ideas as to how that might go forward, whether it is the Manufacturing Initiative or other initiatives, I would be delighted to have that conversation.

Mr. KILMER. Thank you for that. I sure appreciate that. And certainly, I have my office and a number of other Members would, I think, be keen to be part of that happening.

Secretary MONIZ. If that could be a group that we could get together, well, that would be great.

Mr. KILMER. Thank you for that.

If I may ask also what role do you see for the national labs in that broader discussion of impact at the local level and local economies?

Secretary MONIZ. Well, okay. Let me answer one question you didn't ask and one you did ask.

Mr. KILMER. Sure.

Secretary MONIZ. The—first of all, the labs are connected to this Manufacturing Initiative, so, for example, in the 3-D printing, there is a pilot scale project at Oak Ridge and, of course, now we have the manufacturing facility in Ohio there.

In terms of your question, I have spoken with the labs already, the lab directors. I mentioned earlier I met with them about—because we are going to be developing this Quadrennial Energy Review process with a much more state and regional focus, while our labs don't cover quite the entire country, I would like them to be-

come centers of that regional outreach. So that is a process we are going to have to invent. It isn't really there now that well, but we have to do that. That is number one.

Number two is when it comes to technology transfer from the laboratories, I will be honest; I think it is not at a level that we should expect. I think we need to do more. I believe part of that will also come by working with the States because I think it is the innovation ecosystem you need around the lab then to draw all those technologies out. So that is kind of in general terms the kind of vision I have at least for this.

Mr. KILMER. I think that is very true and certainly in my part of the world you would find a private sector that would be very interested in having stronger integration between the lab and private industry.

Secretary MONIZ. Yes, that would be great. Again, I would be—I would love to follow up on that.

Mr. KILMER. Thank you.

Thank you, Madam Chair. I yield back.

Mrs. LUMMIS. I thank the gentleman.

Mr. Secretary, it is eight minutes past noon. Are you able to hang in there with us for a few more minutes?

Secretary MONIZ. A few more minutes, I am sure.

Mrs. LUMMIS. Thank you very much.

The gentleman from Texas has graciously yielded his place in the queue to the gentleman from Utah, Mr. Stewart.

Mr. STEWART. Thank you, Madam Chairwoman.

And thank you, Mr. Weber, for allowing me to jump in here.

Mr. Secretary, thank you for being here. Once in a while, you will read someone's resume and you think, wow. That guy is a lot smarter than I am and—

Secretary MONIZ. Don't believe what you read.

Mr. STEWART. Unlike climate change, this is a matter of fact, not speculation, and your résumé is really quite impressive.

I worked a little bit in the energy and environment sector. I am not an expert on it. I have never claimed to be, but I do know a little bit about it. And I think by far the most important story that we see in the energy world right now, it is not wind, it is not solar, it is not biomass; it is really hydraulic fracking. That has changed the energy world, and frankly, it has changed the world in very significant ways.

It has reshaped the energy map, and as a former military officer—and I can tell you that from a strategic point of view, it has changed the way that I think we view many of the challenges that we face from not just the energy sector but also from a national security point of view.

Secretary MONIZ. Um-hum.

Mr. STEWART. You know, I just want to comment that the United States will surpass Saudi Arabia and also Russia to become the top global oil producer in the next decade. I think that is great news for us. But, Mr. Secretary, by DOE's own report, very, very little of this increased production has happened on Federal lands.

I come from Utah. There are some counties in my district that are 97 percent controlled by the Federal Government, and many of these counties have enormous natural resources. They have re-

sources there that we could be taking advantage of but they unfortunately don't lie on state lands or private lands; they lay underneath Federal lands.

And I am wondering would you commit to us that DOE would be willing to support greater access to Federal lands to take advantage of some of these natural resources?

Secretary MONIZ. Well, sir, I think, you know, first of all, of course, I actually said our production overall is going up dramatically. With regard to the Federal lands, that is clearly something for the Department of the Interior and not something that we have—

Mr. STEWART. Right.

Secretary MONIZ. —any direct engagement with.

Mr. STEWART. I understand that but I am just wondering, you know, with your background and with your expertise, would you say that that was—that would be an appropriate response for us to try to encourage Federal Government to make more available on these Federal lands?

Secretary MONIZ. Well, I think, again, the President supports all-of-the-above, and I think the issue is to see that we continue to grow our domestic production.

Mr. STEWART. Okay. And thank you for that. And I hope the President takes that approach as well.

And then one other comment very quickly knowing that you are extending your time, and this is not something that involved you directly knowing that you are, of course, new in your position and, by the way, have enjoyed, I think, broad bipartisan support. And your—the vote that you had for your nomination, I think, is an indicator of that.

But one thing that I think troubled several of us was this idea of the crony capitalism. If you go back and look over the last four years, you know the Solyndras of the world. And if you look at the very, very high percentage of those people, those companies that had renewable energy companies were backed by the Energy Department, and by some reports as much as 80 percent of them were run by or primarily owned by Obama financial backers.

And I am just wondering if you would respond to that and tell me if you think that is a great idea, which I am supposing you don't and make a commitment once again that there would be not a political influence that would be played into some of these financial backings that the Department takes—

Secretary MONIZ. Well, first of all, I think I want to start by referring back to the Allison Report that suggested that the program in fact has been quite well run. And I have to say in my three weeks I have been impressed with the quality of the people recruited, their financial knowledge in terms of the loan program.

Clearly, we have to evaluate the loans, loan grants under merits. Of course, right now, much of the job is really stewarding the loans that have been made.

As I noted earlier, there are still some outstanding issues like the loan commitment made for the nuclear power plants in Georgia and a possible additional FOA that we might do in fossil that we are considering.

Mr. STEWART. I think you and I can agree, though, that if it is true in the previous four years that 80 percent of these companies had some type of financial ties to the President that that would be an inappropriate measuring stick to whether they would receive DOE funds?

Secretary MONIZ. Well, the motivation for the award clearly has to be on the merits—

Mr. STEWART. On the merits, exactly.

Secretary MONIZ. —of the budget.

Mr. STEWART. Thank you.

Secretary MONIZ. Right.

Mr. STEWART. Thank you for that because that is obviously very true.

And I am going to cede the last 8 seconds of my time. Thank you, Madam Chairwoman.

Secretary MONIZ. Thank you.

Mrs. LUMMIS. The gentleman from Massachusetts thanks you kindly and we now turn to him.

Mr. KENNEDY. Thank you, Madam Chair.

And, Mr. Secretary, it is a pleasure to see you. Thank you for your patience. Thank you for—

Secretary MONIZ. Your constituent.

Mr. KENNEDY. Yes, I know. I am thrilled about that. I hope you are, too. But, nevertheless, we have a bit of a similar background. We both went to Stanford. I hesitate to compare my physics report card with yours, but nevertheless, glad to see you where you sit and glad that I am here as well.

So three points that I just wanted to—or two questions and really one point; I will start with the point first.

Intrigued a little bit, Mr. Secretary, by your response to one of my colleague's questions earlier about STEM and the importance of STEM education really for that foundation going forward for that next generation of engineers and that skill set that we need for whatever those jobs of the future are. I am very intrigued by that training program.

The district that I represent, you are very familiar with, spanned the spectrum in terms of economic outlook. Massachusetts has struggled a bit getting the low-skilled to middle-skilled while we have done well with the high—the middle-skilled to the high-skilled. So I would be thrilled to learn more about and support any of those efforts that you have for a mentorship or trainee program.

Secretary MONIZ. Great.

Mr. KENNEDY. So please just keep us in mind—

Secretary MONIZ. Um-hum.

Mr. KENNEDY. —as that develops.

Now, for the two questions.

First, Mr. Secretary, MIT, as you mentioned and you spoke about this briefly, it is home to one of the world's foremost plasma fusion energy science programs, the C-Mod facility, which I had the pleasure of touring a couple of months ago. Ultimately, the Administration's Fiscal Year 2014 budget request terminates that facility and while proposing an overall increase to the Fiscal Year 2013 enacted levels. The increase in funding request will support the U.S. contribution to the ITER international fusion project.

I know there are sensitivities around this given your former position at MIT, but I just wanted to ask generally your thoughts about the importance of making investments in fusion energy and what that means for that all-of-the-above energy outlook that you talked about going forward if you can.

Secretary MONIZ. Thank you. Well, okay. Respectfully, I cannot answer anything with regard to specifics of the program.

Mr. KENNEDY. Understood.

Secretary MONIZ. General counsel has recused me from that.

In general, in terms of fusion, I think fusion is—actually, I should say fusion and plasma science I think are an important area for continued DOE support. Plasma science really is another kind of phase of matter and then fusion has a long-term—and it is still long-term possibility as an attractive energy source. So I support the general idea of continuing fusion research.

Mr. KENNEDY. And again, Mr. Secretary, keeping it general, as you said, those long-term investments, the—we still—just because it is a long-term horizon doesn't mean that we don't make the investment. Would you agree?

Secretary MONIZ. No, we have to. If you don't make it today, we won't have it in the future.

Mr. KENNEDY. I would agree with you.

And second, building off a little bit of what you said, sir, you talked quite a bit about—and there has been numerous questions today about that all-of-the-above energy strategy. The Fiscal Year 2014 administration budget includes 2.78 billion for the Office of Energy Efficiency and Renewable Energy, which proposes a number of increases to its programs across the board.

You also mentioned in your testimony, sir, the “Race to the Top” initiative as part of your larger focus on national energy policy.

You touched upon this a little bit earlier, sir, but if there are parts of our across-the-board energy portfolio that are not yet cost-competitive because of barriers to technological advancement, how would you propose going forward to lower those barriers to make the technological advances to make it cost-effective?

Secretary MONIZ. Well, I think we need a portfolio of instruments. At the foundation is the basic R&D, which gives us, you know, the new possibilities.

But then, of course, we have something like ARPA-E, which takes promising but still high-risk technologies and moves them hopefully to the place where they become market-attractive for investors. And I think we are seeing a lot of success now developing there and that the program is still new. I mean it is about 3-1/2 years old, well, going on 4, I guess. So that is very, very encouraging.

We also have them in programs and the applied energy programs in selected areas for large-scale demonstrations. The gentleman from North Dakota, for example, mentioned carbon capture and sequestration. That is a place where demonstrating the viability of large-scale storage is just not credible without DOE, without government investment.

And then when it comes to deploying or helping the deployment, then we have things like the loan programs, for example, where—by the way, I didn't get the chance to say this earlier so I will say

it now. The fact is that this loan portfolio, even if we project with uncertainty on some of the remaining loans going forward, we are talking about no more than ten percent loss against the congressionally approved loan loss reserve. That is a pretty good performing portfolio, not to mention things like Tesla paying back a half-a-billion dollars nine years earlier, et cetera, et cetera.

And by the way, Tesla, next year, their announced plan is they are going to become an exporter of vehicles now next year. So that is a great story.

But also, the world largest concentrated solar plant in the California desert just had a ceremony a few weeks ago.

So I guess our view is that we are moving inexorably, as we have for a century, towards a lower-carbon future, and if we want to sit around and not have those technologies developed here, well, we are going to be buyers and not sellers. I believe that we still are the strongest innovation engine. It is a question now of capturing that innovation in our marketplace.

Mr. KENNEDY. Thank you, Mr. Secretary. I yield back. Thank you for the time.

Mrs. LUMMIS. I thank the gentleman and yield to the Vice Chair of our Energy Subcommittee, the gentleman from Texas, Mr. Weber.

Mr. WEBER. Thank you, Madam Chair. They have obviously saved the best for last.

So I am from Texas, the Keystone—the vaunted XL Keystone pipeline would terminate in my district, Mr. Secretary, so we will have a little bit of a discussion about that.

Candidate Obama running for president made the statement that under his energy plan, electricity prices would, of necessity, skyrocket. Do you remember that, ever seen that video?

Secretary MONIZ. No, I did not.

Mr. WEBER. Google it; it is out there.

Secretary MONIZ. Okay.

Mr. WEBER. So my question to you is are you doing everything you can to make electricity prices higher?

Secretary MONIZ. Definitely not. As I have said, cost reduction is my principal goal of innovation.

Mr. WEBER. So you are not following the Commander-in-Chief's edict, then, that electricity prices need to be higher? So you don't share that vein of thought apparently.

Secretary MONIZ. I think we need to have energy costs as affordable as possible.

Mr. WEBER. The things that make America great are the things that America makes, and we need a low, stable energy supply, a very reliable one, and I think we have got one. And doing anything to upset that apple cart would obviously be bad for the economy, bad for national security.

I will move on. Politico just reported that Representative Waxman announced in the Energy and Commerce hearing on fossil fuel export issues that climate change should be a key factor in considering LNG export applications. I have two plants LNG applications in my district. Is the Department of Energy considering climate change in its LNG applications?

Secretary MONIZ. As I said earlier, I am still in the process of getting up to speed, and soon we will be evaluating the dockets. Clearly, the issue is public interest criterion and a set of factors coming in there, environment, economy, security, all of those—

Mr. WEBER. That is a great statement, public interest should be considered. So how would you weight climate change considerations against what I would call economic considerations or, to use yours, public interest? How would you weight those going forward?

Secretary MONIZ. I think that is something that we will have to talk about in our order when we issue an order for the license applications.

Mr. WEBER. Have you had these kinds of discussions with climate change with the White House?

Secretary MONIZ. On the LNG export issue?

Mr. WEBER. Just on climate change in general?

Secretary MONIZ. Oh, yes, climate change in general, certainly.

Mr. WEBER. How many times—how many trips would you say you have made to the White House?

Secretary MONIZ. You mean in the last few weeks?

Mr. WEBER. Sure, in the last few weeks, last year. Is it 2 is it 22?

Secretary MONIZ. Three or four times I—yes.

Mr. WEBER. Three or four times, okay. Well, kind of given the sensitive nature of some of the news reports that have been out lately with some of the revelations, of course, let me just say that, you know, the President said his Administration would be the most transparent administration in history; that was his promise, and it seems like it is getting more and more transparent and it is not very pretty. I want to hold the Department of Energy to a higher standard. Some of the discussion has been about the Solyndras in the days behind us, and I know you are going forward as the new Secretary. Are you sensitive to the fact that that agency—DOE I am talking about specifically—might be used indeed to put pressure on political enemies? Are you sensitive to that fact? In other words, that none of the policies in the DOE would give favoritism toward some of the cronyism that was mentioned here earlier. Do you have a—have you had that discussion with your staff? Do you have a plan in place to make sure it doesn't happen?

Secretary MONIZ. I—first of all, without just talking about the past, going forward—

Mr. WEBER. Um-hum.

Secretary MONIZ. —me—I make it very clear we want to be A) as transparent as possible and as completely open and fair and evaluating everything on the merits.

Mr. WEBER. Well, the last thing we need is—there are so many agencies and you can name them—NSA, IRS—you can go right down the list that have given the public—American public such a bad taste. The last thing we need is the Department of Energy or the EPA which already, I will have to tell you, doesn't have that sterling of a reputation, at least back in my district because they seem to hamper things more than they help. The last thing we need is that kind of reputation to be further promulgated in your agency, so I would charge you going forward that you make sure it doesn't happen.

Let me switch gears. I am running out of time. You said in some of your comments earlier that you think gas has—and I am—this is probably paraphrasing. You said gas has revolutionized the energy industry and should be part of the solution going forward, natural gas we are talking about.

Secretary MONIZ. Absolutely, um-hum.

Mr. WEBER. We have a unique opportunity in the history of the world for America to take the lead, as you heard earlier from one of my colleagues. Are you committed to doing everything you can to get those—that permit process moving forward, especially LNG, natural gas, and making it expeditious so that we can maintain our competitive edge so that we can have that public interest in mind that you yourself talked about?

Secretary MONIZ. Well, again, to clarify, I mean we are not engaged in permitting in terms of production or exploration but in terms of LNG exports certainly. And I have said repeatedly and I intend to be expeditious in going through those cases.

Mr. WEBER. Are you in favor of allowing the Keystone pipeline to come to the Gulf of Mexico?

Secretary MONIZ. That is an issue for the Department of State.

Mr. WEBER. You haven't looked at it at all?

Secretary MONIZ. It is not in—

Mr. WEBER. You have had no discussions with the President or the White House on it?

Secretary MONIZ. No, I—it is not a responsibility of mine. I have not discussed it.

Mr. WEBER. Okay. Well, I was just curious—

Secretary MONIZ. Yes.

Mr. WEBER. —because I want you to do me a favor. When you leave here, I want you to go tell him that we want it in Texas.

Secretary MONIZ. Okay. But you already have the bottom half, right?

Mr. WEBER. Madam Chairman, I yield back.

Mrs. LUMMIS. I thank the gentleman. And I thank the Secretary for his enormous patience today.

The Chair yields to herself—

Secretary MONIZ. Okay.

Mrs. LUMMIS. —for the final round of questions. And my questions are going to revolve around uranium, Mr. Secretary. First of all, does nuclear power add to CO₂ emissions?

Secretary MONIZ. It is essentially carbon-free, right. Um-hum.

Mrs. LUMMIS. Thank you. I want to visit with you about what has been happening with regard to the domestic uranium industry. Sometime ago a ten percent cap was negotiated so that DOE would only transfer, sell, or barter their uranium stockpile at a rate below ten percent of current domestic uranium demand. And that agreement was abrogated and the price of uranium fell through the floor. And my State, which produces a great deal of uranium—albeit domestic supply only supplies ten percent of our uranium for our nuclear power needs—was hurt badly, badly by the DOE's decision to abrogate the ten percent cap.

So I apologize that your predecessor left you holding the bag, but I must ask you now that you are in charge, when does the DOE plan to comply with the law and submit a new management plan?

Secretary MONIZ. We are working on that very actively, and I think we can have a plan ready to bring forward fairly soon.

Mrs. LUMMIS. Thank you, Mr. Secretary.

Secretary MONIZ. Um-hum.

Mrs. LUMMIS. You know, the DOE has the authority, the power to make or break uranium production in this country because of prices and their ability to dump excess product on the market and destroy prices here, thereby making our country actually more reliant on foreign providers of uranium. So I strongly encourage you to come and visit Wyoming—

Secretary MONIZ. Um-hum.

Mrs. LUMMIS. —and our uranium industry to help you better understand the dramatic direct impact that DOE has on our uranium industry.

My next question is about USEC. Over the last 18 months, Dr. Moniz, the taxpayers have been asked to directly subsidize the U.S. Enrichment Corporation to the tune of over \$1 billion in cash for uranium and other incentives. I want to understand how big this hook is that the taxpayers are hanging on. Specifically, is it DOE or is it USEC who is financially obligated to safely decommission the enrichment facility in Paducah, Kentucky, and hand it over to DOE? And how much do you anticipate that costing?

Secretary MONIZ. I cannot give you an exact cost estimate right now, but the USEC will have some responsibilities for the turnover of the plant, probably in some stages. That is still to be worked out in detail, but then the Department will go into cleanup, preparatory to a D&D, decommissioning. And then the issue, which is not dissimilar to that in Piketon, is what can we do with those communities to help provide a new industrial activity that might provide an additional future at those sites. And for Paducah it is well known we have—we at the Department did ask for expressions of interest in terms of what might be done with the site, and that is something we will have to evaluate this year.

Mrs. LUMMIS. Mr. Secretary, what is your opinion about the efficacy of the technology of the American Centrifuge Project?

Secretary MONIZ. Well, that is something that we will need to judge. The intent is that the demonstration of the cascade will—should, assuming funding is there—should end at the end of this year. That is the schedule, and then we have to see whether that looks to be a promising commercial technology and then will come some decisions to be made.

What is the case, of course, I think as you know is the—there is a sensitivity that currently we have no American origin uranium enrichment technology, and consequently, if and when we need enriched uranium for military purposes, we will not have the option.

In fact, if I may comment—maybe a last comment going back to the uranium market, again, we have this report which is, I think, coming along and will be available pretty soon, clearly, I understand completely the issue of balancing the various equities, uranium producers on the one hand, national security requirements on the other. So, for example, if you take Paducah, then a year ago or just—or over a year ago of course there was uranium used at Paducah for an extra year of operation. That was for a well-defined national security purpose to make a tritium reserve for our weap-

ons, whereas the recent proposal for an extension was declined because there was no national security purpose.

Mrs. LUMMIS. Oh, thank you, Dr. Moniz. And there is considerable interest on this Committee on both sides of the aisle on small modular nuclear reactor technology and whether that has promise. I hope that our Subcommittee on Energy will have an opportunity to visit with you informally about—

Secretary MONIZ. Um-hum.

Mrs. LUMMIS. —your understanding of the status of that technology and the viability of that technology going forward.

Secretary MONIZ. Um-hum.

Mrs. LUMMIS. And we would invite you into those discussions at your convenience.

Secretary MONIZ. Great.

Mrs. LUMMIS. I want to thank you so much for your valuable testimony, and I want to thank the Members for their questions.

The Members of the Committee may have additional questions for you, and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments and written questions for Members.

I would like now to offer Ranking Member Johnson, who has been so patient, her opportunity for closing remarks. Do you wish to comment?

Ms. JOHNSON. Well, thank you. I just want to thank the Secretary again for coming—

Secretary MONIZ. Thank you.

Ms. JOHNSON. —and look forward to working with you. And thanks to you.

Secretary MONIZ. Thank you.

Mrs. LUMMIS. I thank the Ranking Member. I want to particularly thank you, Secretary Moniz, for joining us today. As you heard from numerous Members of this Committee, we have high hopes for a very positive working relationship with you going forward, and we look forward to that with a very robust scientific future for our country.

And with that, the—

Secretary MONIZ. I do as well even if we have little arguments sometimes. But I look forward to discussion really.

Mrs. LUMMIS. And the operative word is little—

Secretary MONIZ. Yes.

Mrs. LUMMIS. —because regardless of whether one believes in the role of mankind in increasing the effects of climate change, I think there is general agreement that the climates are changing. The amazing geology of my own—

Secretary MONIZ. Um-hum.

Mrs. LUMMIS. —State of Wyoming bears witness to climate change over eons of time. And if it has been exacerbated by mankind or not, we all agree on this Committee that the importance of giving to our children and grandchildren the best world that we can is in everyone's best interest.

So with that, the witness is excused and this hearing is adjourned.

[Whereupon, at 12:35 p.m., the Committee was adjourned.]

Appendix I

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

*Responses by Secretary Moniz***QUESTIONS FROM LAMAR SMITH****U.S. House Committee on Science, Space, and Technology****Department of Energy Science and Technology Priorities****Tuesday June 18, 2013**

Q1. Dr. Moniz, in 2012 the Department of Energy signed a Memorandum of Agreement with the Department of Interior and Environmental Protection Agency that created a tri-agency research effort to address the highest priority challenges related to unconventional oil gas development. However, despite a January 2013 deadline for a final research plan, the Administration has not yet produced even a draft proposal for Congressional and public review. Nonetheless, at an April Science Committee hearing, DOE testified that it was spending \$10 million on this effort this year. It is very troubling that the Administration is spending millions studying a practice that it is openly aiming to regulate, and yet Congress and the public have no idea what this money is being spent on.

- a) Please provide the committee a detailed description of what this \$10 million in DOE fracking research is being spent on.

A1a. The tri-agency research plan is still under development. The work to date to develop the plan has been very helpful in both coordinating the research efforts of the three agencies and developing the President's FY 2014 Budget Request. The Department's work in this area has focused on developing technologies and best practices to address safety and environmental issues associated with hydraulic fracturing. Currently, FE's work includes unconventional resource characterization, developing technologies for mitigating impacts associated with unconventional gas development, and the treatment and handling of produced water. In addition, DOE is pursuing a range of research activities to support an integrated environmental risk assessment associated with unconventional resource development. This assessment integrates evaluations of risks to water and air quality, as well as issues related to induced seismicity.

Q1b. Will you commit to ensure we receive, as soon as possible, a specific expected completion date of the interagency research plan, as well as to provide the Committee regular briefings on its implementation progress?

A1b. The tri-agency research plan is still under development and work on the plan remains a high priority. The Office of Fossil Energy can provide further information once the plan is complete.

QUESTIONS FROM LAMAR SMITH
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities

Tuesday June 18, 2013

Q2. President Obama has regularly touted—at least during his first term—that his administration would be the most open and transparent Administration in history. I full support greater transparency but have found the President’s commitment lacking in several areas. There appears to be significant room for improvement within DOE, particularly with respect to improved disclosure of where taxpayer dollars are spent and who the beneficiaries are. If so, I would ask:

- a) Do you support making DOE laboratories’ Cooperative Research and Development Agreements (CRADAs) with private companies publicly available?

A2a. Generally, yes; however, DOE is subject to some limitations. The Stevenson-Wydler Act (15 USC 3710a) authorizes CRADAs, but subsection (c)(7) thereof specifically prohibits the disclosure of trade secrets or commercial or financial information that is privileged or confidential, and obtained from a CRADA participant. Public disclosure of labs’ CRADA Agreements must not disclose any such privileged or confidential information. In accordance with the DOE Order 483.1A, statistical information on the CRADAs must be submitted as part of the annual Federal Laboratory technology transfer report, which is available to the public. Additionally, a final technical report, appropriately marked, must be submitted to DOE’s Office of Scientific and Technical Information (OSTI), at the completion or termination of the CRADA. OSTI then makes the information available to the public.

Q2b. Do you support making public DOE’s licensing and intellectual property agreements with its awardees?

A2b. 35 USC 209 sets forth the criteria for licensing federally owned inventions. 35 USC 209(f) requires that each licensee provide a plan for development or marketing of the invention, and goes on to state that any such plan is not subject to disclosure under the Freedom of

Information Act (FOIA). Before public release of such a license agreement, under FOIA or otherwise, agreements would need to be reviewed to possibly remove any information reflecting of embodying a licensee's plan for development or marketing of the invention.

Q2c. Do you support making public the (unclassified) instances when DOE invokes "other transactions authority, OTA"?

A2c. This information is available. For EERE OTAs (often referred to as Technology Investment Agreements or TIAs), there is a press release indicating the award of the OTA/TIA, and interested parties may contact EERE for copies of the TIA agreements. ARPA-E TIAs may be found on the ARPA-E website.

QUESTIONS FROM LAMAR SMITH
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities
Tuesday June 18, 2013

Q3. Dr. Moniz, as you know, last week the White House released a “technical update” to its “Social Cost of Carbon,” figure that is used to estimate the economic benefits of CO₂ emissions avoided by various regulations. This revision now assumes a ton of CO₂ emitted causes \$36 in damages, up from \$22. The revision was first applied in a DOE rule regulating the efficiency of microwave ovens. A DOE press release accompanying the rule stated that its economic benefits would be \$400 million higher as a result of the revision.

- a) Do you agree that placing a dollar value on “social damages” from carbon emissions is a highly speculative and subjective exercise? If so, what is the value and purpose behind such a calculation, beyond making costly regulations appear less harmful?

A3a. Using the best available science and economic information, the Interagency Working Group on the Social Cost of Carbon developed estimates of the net damages due to the emission of one additional metric ton of CO₂ into the atmosphere. The range of values presented is intended to reflect underlying uncertainties in key physical and economic systems. By taking into account the impacts of carbon pollution on human welfare in rulemakings, agencies ensure that such rules are economically justified, based on a balanced assessment of costs and benefits.

Q3b. Do you support requiring agencies to caveat such estimates in their communications so that the public is aware of the uncertainty and subjectivity associated with the claimed benefits of regulatory actions?

A3b. Agencies rely on the best available science and economic information to determine benefits and costs of regulations, noting uncertainties where relevant. The Interagency Working Group on the Social Cost of Carbon noted a number of uncertainties and limitations associated with estimating the social cost of carbon and presented a range of values to reflect that uncertainty.

Q3c. The U.S. emits approximate 7.4 billion tons of CO₂-equivalents each year. According to the new figures from the Obama Administration, at \$36 a ton, elimination of ALL carbon from the U.S. economy would deliver over \$266 billion in benefits. Dr. Moniz, do you agree this is ridiculous, and if so, how do you propose fixing the problem with Social Cost of Carbon estimates?

A3c. Agencies use the best available science and economic information to determine the benefits and costs of regulations, noting uncertainties where relevant. The Interagency Working Group noted a number of uncertainties and limitations associated with estimating the social cost of carbon and presented a range of values to reflect that uncertainty. In addition, the Interagency Working Group committed to updating the social cost of carbon periodically as new scientific or economic information becomes available, ensuring that such estimates remain consistent with the best available information.

Q3d. What is the social benefit of carbon?

A3d. The social cost of carbon includes projected damages and benefits as quantified by the models. Examples of projected benefits in the three peer-reviewed integrated assessment models used to estimate the social cost of carbon include the potential for increased agriculture and forest productivity in some regions, the reduction in energy costs due to reduced heating in some regions, and the potential for some health benefits. These benefits are offset against damages in the net SCC estimates generated by the models.

QUESTIONS FROM LAMAR SMITH
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities
Tuesday June 18, 2013

Q4. Last month, President Obama visited the world-renowned Argonne National Laboratory and gave a speech emphasizing the importance of investments in basic research. Specifically, he said:

“And at a time when every month you’ve got to replace your smartphone because something new has come up, imagine what that means when China and Germany and Japan are all continuing to plump up their basic research, and we’re just sitting there doing nothing.” The President then went on to call on Congress to spend \$2 billion on a new “Energy Security Trust Fund” that would “invest in technologies that would shift our vehicles off of oil for good.”

- a) Would funding spent through the Trust Fund go toward the basic research activities that the President we were “doing nothing” on?
- b) What office within DOE would be responsible for spending money from the Trust Fund, and how would the activities funded by the fund differ from what DOE already spends money on?

A4. No funds have been appropriated for the Energy Security Trust Fund, and therefore precise arrangements for administration of the Fund and detailed allocation of the research funding have yet to be determined. With the support of Congress, the aim of the Fund is to use revenues from federal oil and gas development to support research by American scientists on long-term projects, including research into a range of technologies, such as vehicles that run on electricity, domestically grown biofuels, and domestically produced natural gas. DOE is seeking to achieve cutting-edge discoveries that will shift our vehicles off oil and at the same time to ensure that American scientists and research labs have the support they need to keep our country competitive and create the jobs of the future.

QUESTIONS FROM LAMAR SMITH
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities
Tuesday June 18, 2013

Q5. The United States is currently a partner in ITER, a more than \$20 billion international project (U.S. contribution about \$2 billion) to demonstrate the concept of fusion energy. Unfortunately, this project has been plagued by delays, increased cost estimates, and poor project management and I understand more bad news may be on the way in terms of our European partners' ability to meet their project obligations.

- a) Dr. Moniz, do you have full confidence in the construction and financing of ITER within a reasonable timeframe and cost structure? How will you manage ITER project risks?

A5a. ITER's technical challenges are significant. It has faced unprecedented challenges as a multinational endeavor that must efficiently integrate the most highly technical hardware contributions from the seven partners. In 2009, the U.S. recognized deficiencies in the project's management and helped spur an initiative within the ITER Organization (IO) and among the partner governments that led to leadership and management structure changes in 2010. Furthermore, the U.S. sent one of our own fusion leaders to work at the ITER site for two years.

In the U.S., our in-kind contributions are managed through the U.S. ITER Project Office, located at Oak Ridge National Laboratory (ORNL). ORNL's execution and DOE's oversight of the U.S. project are carried out according to the highest standards of project management within the Department, following the principles of DOE Order 413.3b. This standard requires frequent internal and external reviews that focus on identification and management of risks. These include the identification of additional technical requirements as compared to the initial design (driven in part by scientific discoveries made by U.S. researchers that have been

deemed highly beneficial for ITER), the time and effort required to finalize the design, increases in commodity prices since the Critical Decision-1 cost range was established, and significant variations and uncertainty in Congressional appropriations from year to year. This last factor has had a significant impact on the pace of design activities and early procurements.

Finally, the U.S. depends on the IO and the other ITER Members to deliver their commitments on a timely basis. For example, the earthquake and tsunami that caused the disaster at Japan's Fukushima Daiichi nuclear facilities severely impacted Japanese participation in ITER, adding a year to the schedule. In addition, the European Union (EU) host has faced funding difficulties. Since the EU host contribution is five times larger than that of each of the other six Members and EU work scope is largely on the critical path, the effects of these funding difficulties have been directly and immediately felt throughout the project by the other Members. DOE believes that the EU has overcome these difficulties and has now achieved a level of political consensus to gain approval for their next funding cycle (2014–2020).

QUESTIONS THE HONORABLE CYNTHIA LUMMIS
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities

Tuesday June 18, 2013

Q1. DOE has several active applications for fossil energy loan guarantees that have been outstanding for several months and years. Please provide to this committee the number of applicants outstanding, the amounts requested, and the status of each application made to DOE for fossil energy loan guarantees.

A1. Current applicants for fossil energy loan guarantees as of June 28, 2013 are as follows:

Program	Authority	Sector	Project Name	Requested Loan Amount (\$ in M)
<i>Fossil Projects - Due Diligence Pipeline</i>				
Title 17	1703	Coal Gasification	Project 1	\$ 2,815
<i>Fossil Projects - On Hold</i>				
Title 17	1703	Coal Gasification	Project 2	\$ 1,750
Title 17	1703	Coal Gasification	Project 3	\$ 1,700

Each of these projects has a number of open issues that need to be resolved before DOE could determine, as is required by statute, that there exists "a reasonable prospect of repayment of the principal and interest on the obligation by the borrower." Some of these issues involve local and state legislatures or other governing bodies, on which the Loan Programs cannot force a timeline.

Q2. The Office of Management and Budget is required to do a credit subsidy review of loan guarantee applications. Beyond that, please confirm if there is any other office or individual at OMB or the White House involved in the decision making process for fossil energy loan guarantees. If so, please provide the names of each office and/or individual.

A2. Under the Federal Credit Reform Act of 1990 (Sec. 503), the Director of OMB is responsible for coordinating credit subsidy cost estimates. Under this authority, OMB delegates responsibility for the modeling to agencies, and reviews and must approve subsidy cost estimates

for all loan and loan guarantee programs. OMB works closely with agencies to state accurately the costs of Federal credit programs. Accordingly, OMB reviews and must approve the credit subsidy cost estimates generated by the Department for each loan guarantee issued under the Title XVII program.

Q3. Given the announcement of July 2, 2013, on solicitations for fossil energy loan guarantees, please inform the committee how DOE intends to treat pending applications that have been under consideration. Is the solicitation intended to supplant or supplement the current applications?

A3. The forthcoming Advanced Fossil Energy Projects Solicitation will supplement the existing pipeline mentioned above in Q1.

QUESTIONS THE HONORABLE CYNTHIA LUMMIS
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities

Tuesday June 18, 2013

Q4: DOE has a very small program called the Experimental Program to Stimulate Competitive Research (EPSCoR). I understand that many of the largest energy producing states, including Wyoming, are EPSCoR states. Because of energy activities within their states, these states are already deeply involved in energy research activities. What can we do to strengthen this program and assist the states that are contributing so much to energy production in this nation but receiving a very limited amount of research support from DoE?

A4: The Office of Science believes that the FY 2014 President's Budget Request for the Experimental Program to Stimulate Competitive Research (EPSCoR) is consistent with program needs. EPSCoR exists to improve the capability of designated states and territories to conduct sustainable and nationally competitive energy-related research; jumpstart infrastructure development in designated states and territories through increased human and technical resources, training scientists and engineers in energy-related areas; and build beneficial relationships of designated states and territories with the ten world-class laboratories managed by the Office of Science, leveraging DOE national user facilities and intellectual collaboration. In addition to the EPSCoR program, the FY 2014 President's Budget Request provides a number of opportunities that can contribute to growth of research within the EPSCoR states and territories. These include the recompetition to select new/renew existing Energy Frontier Research Centers (EFRCs). The FY 2014 EFRC solicitation will feature new scientific initiatives including recently identified opportunities in the mesoscale science and in computational design of materials and chemical processes. These topics have been identified as critical to the Nation's energy research enterprise.

Q5: Could you provide a state-by-state listing of the amount of R&D funding made available to each state from DOE during the most recent three years for which information is available?

A5: The following table reflects the distribution to eligible states of funding for the

Experimental Program to Stimulate Competitive Research for FY 2011 to 2013, as well as the

FY 2014 request for the program. The information follows:

(dollars in thousands)

	FY 2011 Approp.	FY 2012 Approp.	FY 2013 Approp.	FY 2014 Request
Alabama	585	0	294	0
Alaska	0	0	896	0
Arkansas	0	0	0	0
Delaware	780	979	330	150
Guam	0	0	0	0
Hawaii	0	0	150	0
Idaho	0	0	0	0
Iowa ^b	0	0	0	0
Kansas	0	150	25	0
Kentucky	590	590	590	0
Louisiana	0	0	0	0
Maine	600	600	600	0
Mississippi	0	0	0	0
Missouri	0	0	0	0
Montana	505	125	140	0
Nebraska	0	0	0	0
Nevada	0	0	0	0
New Hampshire	700	700	0	0
New Mexico	480	150	150	150
North Dakota	600	150	150	150
Oklahoma	0	0	772	0
Puerto Rico	770	1,511	29	0

(dollars in thousands)

	FY 2011 Approp.	FY 2012 Approp.	FY 2013 Approp.	FY 2014 Request
Rhode Island	2,355	1,932	2,137	150
South Carolina	0	0	150	0
South Dakota	0	0	946	0
Tennessee ^b	0	1,333	150	553
U.S. Virgin Islands	0	0	0	0
Utah ^b	0	0	0	0
Vermont	0	0	0	0
West Virginia	300	300	150	0
Wyoming	0	0	757	0
Technical Support	255	0	0	75
Other ¹	0	0	1	7,292
Total, EPSCoR	8,520	8,520	8,417	8,520

Q6. One of DOE's advisory committees is the Basic Energy Sciences Advisory Committee (BESAC). BESAC is responsible for a broad range of programs in material sciences and engineering, chemical sciences, geosciences and the physical biosciences, but BESAC represents a rather concentrated geographic area. How can states like Wyoming participate more fully in DOE's advisory committees?

A6: While the current committee does not include members from the EPSCoR states, BESAC has a rotating membership and has typically included one or more members from the EPSCoR states.

Within the Office of Science, there are six advisory committees that collectively have nine representatives from EPSCoR states, including the chair of the Fusion Energy Sciences Advisory Committee. In composing its advisory committees, the Department had a standing goal of

¹ Uncommitted funds in FY 2013 and FY 2014 will be competed among the EPSCoR states.

^b Iowa, Tennessee, and Utah will lose EPSCoR eligibility in FY 2013; existing awards will continue to their end date.

achieving a broad representation across a variety of factors, including geography, from the leaders in the relevant scientific communities.

QUESTIONS FROM STEVEN PALAZZO
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities
Tuesday June 18, 2013

Q1. Secretary Moniz, the United States has some 25% of the world's coal reserves and it has historically been a major part of our electricity mix in the country. In your opinion what is the future for using coal in the U.S.?

A1. DOE's role in clean coal research and development is to advance technologies related to the reliable, efficient, affordable, and environmentally sound use of fossil fuels. To this end, our research and development is primarily focused on carbon capture and storage, a technology that can permanently reduce carbon dioxide emissions from utility and industrial processes which generate carbon dioxide, including the use of coal.

Q2. I understand that the DOE is a partner with Southern Company in building a new coal gasification power plant in Mississippi that includes carbon capture. Is that project a model for using coal in the future in the U.S.?

A2. The Southern Company coal gasification power plant in Mississippi was originally selected in Round 2 of the Clean Coal Power Initiative (CCPI) to demonstrate advanced power generation systems using Integrated Gasification Combined Cycle (IGCC) technology at a Florida site. As a condition of allowing Southern Company to relocate the project to Kemper County, Mississippi, the project plan was revised to utilize air-blown IGCC technology through a coal-based transport gasifier integrated with carbon capture and storage. The transport gasifier has a fuel-flexible design projected to have higher efficiency and lower capital and operating costs than the currently available oxygen-blown entrained-flow gasifiers. The primary objective of this project is to demonstrate the operation of the commercial-scale gasifier technology integrated with a combined-cycle power island and carbon capture and storage. The further

integration of the plant with Carbon Capture and Storage (CCS) technologies through Enhanced Oil recovery (EOR) will test promising technology advances that will produce electricity from coal while emitting lower levels of carbon dioxide into the atmosphere. This project is one in a suite of technologies being developed, in partnership with the private sector that will ensure the availability of a broad spectrum of environmentally responsible and economically viable energy technologies that allow the utilization of all of our abundant natural resources.

QUESTIONS FROM RANDY HULTGREN
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities

Tuesday June 18, 2013

Q1. With the recent news that the Chinese have surpassed the United States and now run the world's fastest computer, where do you think there are opportunities to shift funding at the DOE where we would get more "bang for our buck" with exascale computing instead of existing expenditures in other areas? Also, to what extent would you hope to coordinate the activities of the Office of Science with the NNSA?

A1. The Department of Energy (DOE) is starting a strategic portfolio review to prioritize these choices and is a strong supporter of exascale and high performance computing. There is a MOU between the Office of Science and NNSA to coordinate exascale activities. NNSA's Office of Advanced Simulation and Computing continues to work with the DOE Office of Science on future computing systems, including exascale systems. One example of this collaboration is the Fast Forward program where SC and NNSA are partnering with U.S. industry to accelerate the development of critical technologies for exascale such as memory, processors, storage and interconnects. DOE is jointly executing R&D activities that are on the path to eventual deployment of an exascale system and planning high-performance computing (HPC) systems software activities. In the near term, Los Alamos and Lawrence Berkeley National Laboratories are working together on the procurement of the next generation petascale platforms, Trinity and NERSC-8, which will be sited at Los Alamos and Lawrence Berkeley National Laboratories for their respective sites. DOE has also initiated joint planning for pre-exascale machines to be deployed in the 2017-8 timeframe. NNSA continues to partner with DOE Office of Science to make the most effective use of government resources in meeting their differing mission needs.

QUESTIONS FROM ZOE LOFGREN**U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities****Tuesday June 18, 2013**

Q1. Secretary Moniz, thank you for testifying before the Science Committee, and I apologize for being unable to attend the hearing in person. However, having reviewed the transcript, I had several additional questions I would like you to respond to for the record. In your appearance before our Committee on June 18th, representative Swalwell asked you about the recently completed and fully operational, National Ignition Facility at Lawrence Livermore National Lab. At the time you said you had “not yet had the chance to drill down into it.” But that you acknowledged its importance in our science-based Stockpile Stewardship Program. I would ask that you now “drill down” and get back to us with your thoughts on NIF, its importance for Stockpile Stewardship and fundamental high-energy physics, and its capability to fulfill – what I hope you will agree are – its critical responsibilities under the President’s Budget Request. In your responses to Rep. Swalwell, you were hesitant on NIF’s role in Inertial Confinement Fusion energy research. While everyone agrees that NIF was built and funded with the primary aim of stockpile stewardship, I hope in your drilling down you will recognize that since its inception, advancing research in ICF for energy has been an explicit and important aim. I hope you will also see that achieving ignition, whether for SSP or energy research required basically the same approach, and is critically important to continue pursuing.

To clarify, please address:

- a) Your opinion of the National Ignition Facility and its role in the NNSA.
- b) Your assessment of the current scientific merit of the ICF program, and NIF research.
- c) The role you see for the NIF and ICF under Secretaryship.
- d) Whether you believe the President’s Budget Request will allow the NIF to serve its primary purpose of advancing the Stockpile Stewardship Program, and its other purposes of advancing fundamental physics research, investigating the possibility of ICF for energy, maintaining a highly skilled workforce, and retaining the United States’ position at the forefront of all of these fields.
- e) Your thoughts on the recent National Research Council report entitled An Assessment of the Prospects for Inertial Fusion Energy, which makes a strong case for continuing IFE research and NIF’s key role in doing so.

A1a. DOE is supportive of the National Ignition Facility (NIF) role as a scientific facility for High Energy Density (HED) science in support of the Department’s missions. With budgets,

objectives and operational costs appropriately defined, NIF will continue to play a key role in maintenance of the scientific vitality of the laboratories DOE relies upon to support stockpile stewardship.

A1b. During the National Ignition Campaign (NIC), NIF was focused on bringing up the NIF facility and on pursuing the planned, specific approach to achieving ignition. With the end of that NIC in FY 2012, the NIF experimental program has become much broader with much more participation by and input from the broader weapons and HED science communities. The NIF experimental promise is just now coming to fruition and there is continued improvement in the quality of data returned by an evolving suite of diagnostics, as DOE explores the reasons why the NIF point design failed to achieve ignition as well as superb research results in areas important to stockpile stewardship such as radiation transport experiments and experiments to measure the properties of materials at very high pressures.

A1c. The Inertial Confinement Fusion (ICF) program remains vital for NNSA to maintain its capabilities in HED science in support of stockpile stewardship. NIF is a key facility in support of that mission and achieving ignition or understanding why we have failed to achieve ignition, and important to maintaining our scientific understanding in these key areas.

The weapons program is highly dependent upon computer codes to predict the safety, reliability, and performance of our nuclear weapons, particularly in regard to proposed changes, modifications, or refurbishments to maintain a modern stockpile two decades after the cessation of underground nuclear explosive tests. NIF provides a superb platform for testing codes and models in physical regimes that are relevant to nuclear weapons. Indeed, we already are learning much from exploring why our codes predicted that we would achieve ignition on NIF, even

though it has not yet been achieved. Maintaining the ability to conduct exciting and challenging science in relevant regimes also is key to training and recruiting scientific staff in areas relevant to maintaining our stockpile.

A1d. As you recall, after completion of NIF construction, DOE undertook the NIC at the behest of the Congress as an Enhanced Management Program to bring the rigor of project management to the commissioning of NIF, the installation of key diagnostics and cryogenic equipment, and the performance of the first ignition experiments. Although the first ignition experiments were to be completed by the end of FY 2010, because of technical delays and scientific challenges, the NIC was extended through the end of FY 2012.

Maintaining an effective experimental program with the \$329 M per year requested to support the Lawrence Livermore National Laboratory (LLNL) ICF program including NIF operations is a challenge, but given present budget constraints it is important that NNSA operate the NIF in the most efficient and productive manner possible. NNSA is preparing the actions it will take to provide the required information requested by the Senate Energy and Water Development Committee within 120 days of enactment of the FY14 National Defense Authorization Act on the costs of operating NIF. As NIF is a new facility, this is not a review that has been performed before, and it is appropriate to study the issue in depth. Once that work is complete, DOE can evaluate the appropriateness of the present level of funding and can identify further opportunities for improvements or additional experimental capabilities that might be proposed with increased funding levels in future budget requests.

To put the 2014 President's request of \$329 M for NIF and ICF at LLNL into perspective, the NIF will remain the most expensive scientific facility operated by the DOE, and the \$329M should be sufficient funding to execute a substantial body of experimental work.

A1e. The National Academy of Sciences' (NAS) National Research Council (NRC) 2013 report entitled *An Assessment of the Prospects for Inertial Fusion Energy* reached several important conclusions regarding the future of an Inertial Fusion Energy (IFE) program in the Department of Energy. One key conclusion was: "The appropriate time for the establishment of a national, coordinated, broad-based inertial fusion energy program within DOE is when ignition is achieved [Conclusion 4-13]."

This is consistent with the 2012 *NNSA's Path Forward to Achieving Ignition in the Inertial Confinement Fusion Program* report requested by the Congress that set out a balanced approach to the quest for ignition with the present indirect drive scheme while also attempting to understand the reasons for not yet having achieved ignition. The NAS study is also consistent with key conclusions of the accompanying subcommittee report to the NRC report *Assessment of Inertial Confinement Fusion Targets*. This report noted that: "the national program to achieve ignition using indirect laser drive has several physics issues that must be resolved if it is to achieve ignition [Conclusion 4-1]." This subcommittee report further predicts that it will take a significant effort to resolve these issues: "Based on its analysis of the gaps in current understanding of target physics and the remaining disparities between simulations and experimental results, the panel assesses that ignition using laser indirect drive is not likely in the next several years [Conclusion 4.2]."

NNSA's Path Forward is balanced between the main indirect drive approach and the alternative approaches: polar direct drive and magnetic fusion. This balance is consistent with the NAS study which concluded that "the prospects for ignition using laser direct drive have improved enough that it is now a plausible alternative to laser indirect drive for achieving ignition and for generating energy [Conclusion 4-6]." It also found that "Sandia National Laboratory is leading a research effort on a Z-pinch scheme that has the potential to produce high gain with good energy efficiency, but concepts for an energy delivery system based on this driver are too immature to be evaluated at this time [CONCLUSION 4-13]."

Q2. In your written testimony, you touched on the importance of NNSA science investments: "This national security investment provides a strong basis for transitioning to a smaller yet still safe, secure and effective nuclear stockpile. It also strengthens the science, technology and engineering base of our enterprise." One key tool in that national security investment is the NIF. In the recent stockpile stewardship and Management Plan you referred to in your testimony, NNSA says the NIF and similar facilities "have had considerable impact on NNSA's ability to meet national security challenges, attract and retain a premier workforce, and maintain the preeminence of its laboratories as world leaders in science," and they have called it their flagship facility. Do you agree that NIF is a critical element of the stockpile stewardship program and the Department of Energy's research enterprise?

A2. The National Ignition Facility (NIF) is entirely funded through the NNSA. DOE, including NNSA, is facing substantial budget pressures, and it is important that NIF's funding be kept in balance with other NNSA stockpile priorities.

Whereas there are strong overlaps between NNSA's mission and information required to support Inertial Fusion Energy (IFE), IFE technology development or specific IFE research is outside of NNSA's mission space. As suggested by the NAS study on IFE, the appropriate time to consider an IFE Program is after we have achieved ignition.

Q3. Recently, in testimony before the Senate Armed Services Committee, Livermore National Lab Director Parney Albright, said "will significantly limit our ability to utilize the National Ignition Facility and undermine [our nuclear] stewardship programme." He went on in detail

about the layoffs (staff reductions are already occurring) and the diminishment of research capacity that would occur.

- a) Are you concerned that severe budget cuts at the National Ignition Facility could hinder stockpile stewardship, energy research, critical workforce maintenance, and the United States' leadership in high-energy density physics and inertial confinement fusion?
- b) Was the Livermore National Lab scientific staff and management consulted in the budget process as to the potential impacts of the proposed budget cuts?

A3a. When viewed as a whole DOE believes the Stockpile Stewardship Program is balanced and sufficiently well-funded to accomplish the national security missions of the country and to maintain the workforce necessary to do so. Between the National Ignition Facility, the Omega laser at the University of Rochester, and the Z-facility at the Sandia National Laboratories, NNSA's world leadership in high energy density science is not in jeopardy. DOE believes that there is sufficient funding to make progress on ignition, which is the key issue that must be addressed before the DOE can consider whether development of an Inertial Fusion Energy program should be pursued.

A3b. As is standard practice, the President's budget request is embargoed until it is released to the Congress.

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Q4. You didn't mention fusion in your testimony, to follow up on Representative Kennedy's question at the hearing:

a) Do you support the DOE's existing fusion research program?

A4a. Yes.

Q4b. Do you think fusion energy has a role in our future energy supply?

A4b. The historical progress in fusion has been substantial, and DOE is now on the verge of critical tests of its feasibility through ITER, which will be the first experimental platform to produce a self-sustaining fusion reaction. Success could yield substantial benefit to our future energy picture. Fusion may have a role in contributing to the U.S. and world energy economy later in this century. It is also important to note that fusion energy would have zero greenhouse gas emissions.

Q4c. The history of fusion research is plagued by budget cuts and shifting goals. Do you think we are currently pursuing fusion with an appropriate focus and commitment?

A4c. With the FY 2014 President's Budget Request, the U.S. continues to have a strong investment in fusion research. The proposed budget will enable us to meet our international commitments to ITER and sustain a viable domestic U.S. program that will continue to make significant contributions to resolving vital issues in fusion research.

The FY 2014 budget proposal positions the program to maximize the scientific return of our investment in ITER; address gaps in materials science, required for harnessing fusion energy; continue to steward the broader plasma sciences, taking advantage of cross-agency synergies,

and provide opportunities for U.S. scientists to do research on a billion-dollar-class of new international superconducting facilities.

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Q5. The National Research Council recently completed a 2-year survey of the possibilities for Inertial Confinement Fusion Energy. They found that, given the huge potential benefits to society, it was well worth pursuing. They further found that the National Ignition Facility was the key tool for advancing this research. Given this expert endorsement, why has the funding for NIF been so severely cut in the president's budget?

- a) The budget documents said the NIF "failed to achieve ignition in 2012 as scheduled." Doesn't this misunderstand the nature of discovery science? Discoveries don't happen on a deadline, or we would have cured cancer in 1976.

A5a. Up through the end of FY 2012, NNSA committed to continuing the focused program on the path for ignition that was laid out in the LLNL generated NIC Execution Plan. NNSA anticipated that ignition could be more challenging, and thus, ignition may take longer than planned. Based on the input from technical experts in the community, DOE resourced the NIC sufficiently well to ensure that only technical, and not fu

nding, issues would prevent meeting a 2012 goal. In the last year of that effort, however, external review committees became increasingly critical of the schedule-driven approach being pursued under the laboratory's plan, and the NNSA Path Forward report laid out an approach that enabled discovery science to explore the issues and opportunities for alternative approaches to ignition. NNSA had not intended that the rate of expenditures to bring the NIF up to full capability and to maintain the focused pace of the NIC would continue beyond the NIC.

Moreover, given budget pressures and further pressures to increase the productivity of various stockpile activities including planning and delivering on various life extension program options, NNSA—in collaboration with the Department of Defense and the approval of the Nuclear

Weapons Council—revised program priorities. NNSA remains committed to funding NIF at the President's budget request.

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Q6. A scientist from the Bay Area recently told me, in his opinion, given the success and investment at the Large Hadron Collider (LHC) at CERN, in Switzerland, the US had ceded leadership in the high-energy physics space, and should focus on maintaining leadership in Astronomy and Cosmology. Given the cuts to the National Ignition Facility, the Office of Fusion Energy Science's domestic programs and the High Energy Density Physics program, is the President's budget agreeing with that assertion? I would also like to reiterate Rep. Swalwell's invitation to visit the facility as soon as you are able, it is a truly impressive facility and located in a beautiful part of the country very close to three other DOE national labs to also visit.

A6. Fundamental nuclear physics, particle physics and high energy physics have always been international endeavors in which the U.S. has played a prominent role. The LHC at CERN is indeed the preeminent high energy physics accelerator in the world today, but the U.S. plays a significant role in experimental work undertaken at that facility. The recently announced discovery of the Higgs boson involved two detectors, ATLAS and CMS, and U.S. scientists from dozens of U.S. laboratories and academic institutions played prominent roles in designing, building, fielding, and maintaining the detectors and in analyzing the resulting data. An American physicist heads the CMS collaboration. This support is continued in the President's FY 2014 budget request as well as leading U.S. roles in astrophysics and cosmology.

High Energy Density Physics (HEDP) and High Energy physics are separate fields of investigation, though there is some overlap in the area of astrophysics. In searching for the Higgs boson, the LHC investigated the results from the collision of just two protons each at energies of up to 7 teraelectron volts (7×10^{12} electron volts). The high energy density physics experiments on the NIF, by contrast, investigates properties of a plasma at temperatures of up to 5 kilovolts (5×10^3 electron volts) without ignition and perhaps 10 times as high if ignition were to be

achieved. This is nearly one billionth the energy per particle, but instead of investigating the product of the collision of just two particles, HEDP looks at the behavior of a plasma with a minimum of 10^{19} particles for even the smallest investigations.

NIF will remain the most powerful laser for performing HEDP investigations for the foreseeable future. The NIF Path Forward report provided to the Congress in 2012 laid out a program of work that provides substantially increased emphasis on HEDP science decreasing the focus on facility investments now that NIF has reached its designed operational capability. Senate Report 113-47 accompanying the Energy and Water Development appropriations bill for FY 2014 requested a report from the NNSA on improving operating efficiencies at NIF assuming that NIF will be funded at the \$329M President's request for the next three years. NNSA is developing an approach to studying the issue and reviewing the results to ensure that NIF is achieving the highest scientific productivity possible.

QUESTIONS FROM ELIZABETH ESTY
U.S. House Committee on Science, Space, and Technology
Department of Energy Science and Technology Priorities

Tuesday June 18, 2013

Q1. Secretary Moniz, you spoke in your remarks about the importance of continued support for ARPA-E, the Advanced Research Projects Agency-Energy, so that we may continue to invest in high-risk, high-reward projects. I believe that we have a duty to invest in technology research and development, but I also know the importance of translating R&D into manufacturing jobs for the American people and for firms, many of which are small businesses, in Connecticut.

A1. Due to ARPA-E's focus on the early stages of technology development and the short time-period of its projects, each project team is expected to establish a credible path to additional funding, partnerships, and/or commercialization once the ARPA-E award is completed. ARPA-E refers to this as a 'hand-off' to the next stage of the project. To facilitate this hand-off ARPA-E has a dedicated technology-to-market team that partners with project teams from the start of their project to help identify a commercialization path based on the specific technology and target market.²

Q2. The House Appropriations Subcommittee on Energy and Water Development FY14 appropriations bill proposes an 81% reduction in funding for ARPA-E, providing just \$50 million for the program. Given the extent to which the majority is threatening to gut the program, can you talk in greater detail about some of the success stories from ARPA-E funding, and how that has translated into job creation for our nation.

A2. DOE supports the Administration's request of \$379 million for FY2014, as detailed in the Budget Justifications.³ The House Appropriations Committee mark of \$50 million represents an 82% and 87% cut from the FY2013 enacted level⁴ and the FY2014 budget request, respectively.

² For more information on ARPA-E's "Technology-To-Market" approach, see: <http://arpa-e.energy.gov/?q=arpa-e-site-page/tech-market-t2m>

³ For more information, please see ARPA-E's section of Volume IV of the FY2014 DOE Detailed Budget Justifications: <http://arpa-e.energy.gov/sites/default/files/ARPA-E%20FY14%20Budget%20Request.pdf>

⁴ P.L. 113-6, Division F, Title II, Sec. 1203 set ARPA-E FY2013 budget at \$265 million. The percentage change values used in comparing FY2013 to FY2014 do not take into account the effects of the budget sequestration enacted by P.L. 112-25 (as amended).

While the funding level was increased to \$70 million via an amendment in the Committee of the Whole, this still represents a 75% cut from FY2013 enacted. This funding reduction would impact the ability of ARPA-E to fund energy research. While ARPA-E focuses on nimbly responding to recent technical discoveries and market events, and in the past it has not funded projects with out-year mortgages, a large portion of a budget so reduced would need to be devoted to relatively fixed costs. These costs include oversight of prior year projects to ensure prudent use of taxpayer funds. As a result, ARPA-E would likely only initiate one or two new programs during FY2014.

While it is simply too soon to determine whether ARPA-E funded innovations will have transformational market impact, ARPA-E does measure technical indicators for its projects and, most importantly, preliminary indicators for commercial adoption. Technological indicators include patents (applied for and issued), publications, and whether projects achieve the technical milestones laid out by their program managers, including some 'world record' performances. The 285 ARPA-E performers funded thus far have applied for over 34 patents for technologies resulting from ARPA-E awards and have been awarded at least 16 to date. ARPA-E awardees have published 48 papers in technical journals.

Some technical achievements include:

- **Batteries:** An ARPA-E awardee announced the world record in energy density at 400 Wh/kg for a rechargeable lithium-ion battery, doubling the capacity of today's batteries. This advance could cut battery costs by half, perhaps enabling electric cars with comparable range and cost as gasoline-powered cars.
- **Power Electronics:** An ARPA-E awardee has had early success in developing a 1 MW transistor the size of a human fingernail made of silicon carbide. If successful, the higher frequencies enabled by the transistor would allow for a much smaller transformer itself. A 1000 kVA transformer could then shrink from 8,000 pounds to only 100 pounds; it would require fewer materials and could be deployed closer to end users. This would greatly reduce costs and increase reliability for the electric grid.

- Biofuels: An ARPA-E awardee succeeded in engineering microbes that use hydrogen and carbon dioxide to make liquid transportation fuel. Further, this was done without sunlight and has the potential to be 10 times more efficient than current photosynthetic biofuels.
- Grid Scale Storage: An ARPA-E awardee developed a near-isothermal compressed air energy storage system that prevents air from heating up during compression and cooling down during expansion. When integrated with renewable energy generation, such as a wind farm, this technology would allow intermittent energy to be stored as compressed air in salt caverns or pressurized tanks. Unlike conventional compressed air energy storage, no gas is burned to convert the stored high-pressure air back into electricity. The result of this breakthrough is an ultra-efficient, fully shapeable, 100 percent renewable, and carbon-free power product.

