OVERVIEW OF THE ADMINISTRATION'S FEDERAL RESEARCH AND DEVELOPMENT BUDGET FOR FISCAL YEAR 2013

HEARING

BEFORE THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

FEBRUARY 17, 2012

Serial No. 112–61

Printed for the use of the Committee on Science, Space, and Technology

Available via the World Wide Web: http://science.house.gov

U.S. GOVERNMENT PRINTING OFFICE
73–121PDF WASHINGTON : 2012

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HON. RALPH M. HALL, Texas, *Chair*

F. JAMES SENSENBRENNER, JR., Wisconsin
LAMAR S. SMITH, Texas
DANA ROHRABACHER, California
ROSCOE G. BARTLETT, Maryland
FRANK D. LUCAS, Oklahoma
JUDY BIGGERT, Illinois
W. TODD AKIN, Missouri
RANDY NEUGEBAUER, Texas
MICHAEL T. McCAUL, Texas
PAUL C. BROUN, Georgia
SANDY ADAMS, Florida
BENJAMIN QUAYLE, Arizona
CHARLES J. "CHUCK" FLEISCHMANN, Tennessee
E. SCOTT RIGELL, Virginia
STEVEN M. PALAZZO, Mississippi
MO BROOKS, Alabama
ANDY HARRIS, Maryland
RANDY HULTGREN, Illinois
CHIP CRAVAACK, Minnesota
LARRY BUCSHON, Indiana
DAN BENISHEK, Michigan
VACANCY

EDDIE BERNICE JOHNSON, Texas
JERRY F. COSTELLO, Illinois
LYNN C. WOOLSEY, California
ZOE LOFGREN, California
BRAD MILLER, North Carolina
DANIEL LIPINSKI, Illinois
DONNA F. EDWARDS, Maryland
MARCIA L. FUDGE, Ohio
BEN R. LUJÁN, New Mexico
PAUL D. TONKO, New York
JERRY McNERNEY, California
JOHN P. SARBANES, Maryland
TERRI A. SEWELL, Alabama
FREDERICA S. WILSON, Florida
HANSEN CLARKE, Michigan
VACANCY

CONTENTS

Friday, February 17, 2012

OVERVIEW OF THE ADMINISTRATION'S FEDERAL RESEARCH AND DEVELOPMENT BUDGET FOR FISCAL YEAR 2013

FRIDAY, FEBRUARY 17, 2012

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

The Committee met, pursuant to call, at 9:34 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Ralph Hall [Chairman of the Committee] presiding.

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

An Overview of the Administration's Federal Research and Development Budget for Fiscal Year 2013

February 17, 2012
9:30 a.m. to 11:30 a.m.

2318 Rayburn House Office Building

Witness List

Dr. John P. Holdren
Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy (OSTP)

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

HEARING CHARTER

An Overview of the Administration's Federal Research and Development Budget for Fiscal Year 2013

Friday, February 17, 2012
9:30 a.m. – 11:30 a.m.
2318 Rayburn House Office Building

1. Purpose

On Friday, February 17, 2012, the House Committee on Science, Space, and Technology will hold a hearing to examine President Obama's proposed fiscal year 2013 (FY13) budget request for research, development, demonstration, and commercial application programs. Dr. John P. Holdren, Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy (OSTP), will review the proposed budget in the context of the President's overall priorities in science, space, and technology and will describe the mechanisms the Administration uses to determine priorities across scientific disciplines and the mechanisms used to coordinate scientific research and technical development activities across federal agencies. The Committee will hold separate hearings to examine the FY13 budget requests of individual agencies within its jurisdiction over the next few weeks.

2. Witness

Dr. John P. Holdren is the Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy. He also serves as Co-Chair of the President's Council of Advisors on Science and Technology (PCAST). Prior to joining OSTP, Dr. Holdren was the Teresa and John Heinz Professor of Environmental Policy and Director of the Program on Science, Technology, and Public Policy at Harvard University's Kennedy School of Government, as well as Director of Woods Hole Research Center.

3. Table of Contents

4. Overview

Overall Budget

Under the President's proposed budget for FY13, overall discretionary spending decreases from $1.2 trillion to $1.15 trillion to meet the caps as agreed to in the Budget Control Act of 2011. However, the budget calls for "strategic increases in the U.S. research and development (R&D) enterprise and a strong focus on science, technology, engineering, and mathematics (STEM) education."[1] As such, the budget request includes discretionary funding increases for all agencies within the Committee's jurisdiction, with the exception of NASA which is reduced by $59 million (or .3 percent). Specifically, funding increases percentages are as follows: Department of Energy R&D (8 percent), Department of Energy Office of Science (2.6 percent), the National Science Foundation (4.8 percent), the National Institute of Standards and Technology (14.1 percent), the National Oceanic and Atmospheric Administration (3.3 percent), the Environmental Protection Agency (1.2 percent), the Department of Homeland Security Science and Technology Directorate (24.5 percent), and the Department of Transportation (14 percent).

Research and Development (R&D) Budget

Overall Federal Research and Development Spending[2]

(dollars in millions)

Agency	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Enacted $	FY13 Request versus FY12 Enacted %
Department of Defense	77500	72739	71204	(1535)	-2
Department of Health and Human Services	31186	31153	31400	247	1
Department of Energy	10673	11019	11903	884	8
NASA	9099	9399	9602	203	2
National Science Foundation	5486	5680	5904	224	4
Department of Agriculture	2135	2331	2297	(34)	-1
Department of Commerce	1275	1258	2573	1315	105
Department of Transportation	953	944	1076	132	14
Department of Homeland Security	664	577	729	152	26
Department of Veterans Affairs	1160	1164	1166	2	0
Department of the Interior	757	796	854	58	7
Environmental Protection Agency	584	568	580	12	2
Department of Education	362	392	398	6	2
Smithsonian Institution	259	243	243	0	0
Patient-Centered outcomes Research Trust Fund	40	120	312	192	160
Other	581	486	579	93	19
Totals:	**142714**	**138869**	**140820**	**1951**	**1**

Shading indicates agencies within the Science, Space, and Technology Committee's jurisdiction

[1] OSTP FY13 R&D Budget Press Release.
(http://www.whitehouse.gov/sites/default/files/microsites/ostp/fy2013rd_press_release.pdf)

[2] *Fiscal Year 2013 Analytical Perspectives, Budget of the U.S. Government*, OMB, p. 370.

The President's FY13 budget proposes a total of $140.8 billion for research and development (R&D) across all agencies, a $1.9 billion or one percent increase over the FY12 enacted level. The budget would decrease defense-related R&D spending by $1.5 billion or two percent to $71.2 billion and increase health-related R&D by $439 million or 1.4 percent to $31.7 billion.[3] Therefore, the total non-defense R&D budget request is $69.6 billion, but the total FY13 budget request for all other non-defense and non-health specific R&D, an overwhelming majority of which is in the Committee's jurisdiction, is $37.9 billion or a 8.7 percent increase over the FY12 level. This amount includes basic and applied research, development, and facilities and equipment.

The President's proposed FY13 budget does not treat R&D uniformly, but rather provides significant increases in priority areas, while reducing or freezing spending in other areas. Therefore, aggregate numbers mask the wide variation in individual agencies and programs. The budget request provides $13.1 billion for the three physical science research agencies included in America COMPETES – research funding at the National Science Foundation (NSF), internal programs at the National Institute of Standards and Technology (NIST) and the Department of Energy's Office of Science (DOE). With the exception of the Department of Commerce, which receives a significant increase of 105 percent; the Department of Homeland Security Science and Technology Directorate, which receives a 24.5 percent increase; the Department of Transportation, which receives a 14 percent increase; DOE R&D, which receives an eight percent increase; and NSF, which receives a four percent increase; all other agencies within the Committee's jurisdiction receive modest increases of two percent or less.

5. Interagency Research Activities[4]

Interagency Research Activities Spending

(dollars in millions)

Interagency Program	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Estimate $	FY13 Request versus FY12 Estimate %
National Nanotechnology Initiative (NNI)	1845	1696	1766	70	4.1
Networking and Information Technology R&D (NITRD)	3725	3738	3807	69	1.8
US Global Change Research Program (USGCRP)	2448	2427	2563	136	5.6

National Nanotechnology Initiative (NNI)

The Science, Space, and Technology Committee was instrumental in the development and enactment of the 21st Century Nanotechnology Research and Development Act of 2003 (P.L. 108-153), which authorized the NNI. The NNI focuses on R&D that creates materials, devices, and systems that exploit the fundamentally distinct properties of matter as it is manipulated at the nanoscale. There are currently 25 federal agencies that participate in NNI, with 15 of those agencies reporting a nanotechnology R&D budget.

---

[3] This includes a budget request of $312 million (160 percent increase) for the Patient-Centered Outcomes Research Trust Fund as mandated in the Patient Protection and Affordable Care Act.

[4] Budget numbers and details for the NNI and NITRD programs are taken from the R&D Summary Fact Sheet provided by OSTP. (http://www.whitehouse.gov/sites/default/files/microsites/ostp/fy2013rd_summary.pdf). Details may change with the release of the Supplement to the budget for these programs.

The FY13 budget request for NNI is $1.8 billion, an increase of $70 million or 4.1 percent over the FY12 level. The Administration's budget request continues funding for three signature initiatives: Nanoelectronics for 2020 and Beyond; Sustainable Manufacturing: Creating the Industries of the Future; and Nanotechnology for Solar Energy Collection and Conversion. The DOE contribution will increase to $443 million, a $127 million or 40.3 percent increase. Likewise, EPA sees an 11.8 percent increase, NIST receives a seven percent increase, NSF a two percent increase, and the Department of Transportation a 100 percent increase from $1 million to $2 million. All other agency funding is reduced by a total of $76 million.

Networking and Information Technology R&D (NITRD)

The Science, Space, and Technology Committee was also instrumental in the development of the multi-agency NITRD program through the High Performance Computing Act of 1991 (P.L. 102-194). The mission of the NITRD program is to accelerate progress in the advancement of computing and networking technologies and to support leading edge computational research in a range of science and engineering fields, including high-end computing systems and software, networking, software design, human-computer interaction, health IT, and cybersecurity and information assurance research activities. Information technology research continues to play a critical role in U.S. economic strength. Currently, 14 federal agencies contribute funding to the NITRD program and additional agencies participate in planning activities. On February 7, 2011, the Committee ordered to be reported H.R. 3834, *Advancing America's Networking and Information Technology Research and Development Act of 2012*. This measure updates and further codifies the NITRD program and is similar to H.R. 2020 from the 111th Congress that passed the House twice, but was not enacted.

The FY13 NITRD budget request is $3.8 billion, a $69 million or a 1.8 percent increase over the FY12 level. The Administration request includes a focus on research to improve our ability to derive value and scientific inferences from enormous quantities of data, and continues to emphasize foundations for assured computing and secure hardware, software, and network design and engineering to address the goal of making Internet communications more secure and reliable. The DHS request includes a significant increase of 36.2 percent; the Department of Commerce is increased by 16.4 percent, NSF by 6.1 percent, and DOE by 5.9 percent. All other agency funding is reduced by a total of $71 million.

U.S. Global Change Research Program (USGCRP)

The FY13 budget request is $2.6 billion for the interagency USGCRP, a $136 million or 5.6 percent increase over FY12 level, bringing federal climate research funding to the highest level ever. Started in 1989, the USGCRP is an interagency effort comprised of 13 departments and agencies. Activities of the USGCRP are grouped under the following areas: improving knowledge of Earth's past and present climate variability and change; improving understanding of natural and human forces of climate change; improving capability to model and predict future conditions and impacts; assessing the Nation's vulnerability to current and anticipated impacts of climate change; and improving the Nation's ability to respond to climate change by providing climate information and decision support tools that are useful to policymakers and the general public. Participating agency budgets for the program are as follows: USGS is increased by 15.3 percent, DOE by 9 percent, NOAA and NIST collectively by 7.2 percent, NASA by 5.7 percent, EPA by 5.3 percent, Agriculture by 3.6 percent, and DOT by 200 percent from $1 million to $3 million. NSF, NIH, and the Smithsonian funding requests remain flat.

6. Agency R&D Highlights

National Aeronautics and Space Administration (NASA)

National Aeronautics and Space Administration (NASA) Spending

(dollars in millions)

Account	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Estimate $	FY13 Request versus FY12 Estimate %
Science Mission Directorate	**4919.7**	**5073.7**	**4911.2**	**(162.5)**	**-3.2**
Earth	*1721.9*	*1760.5*	*1784.8*	*24.3*	*1.4*
Planetary	*1450.8*	*1501.4*	*1192.3*	*(309.1)*	*-20.6*
Astrophysics	*631.1*	*672.7*	*659.4*	*(13.3)*	*-2.0*
James Webb Space Telescope	*476.8*	*518.6*	*627.6*	*109.0*	*21.0*
Heliophysics	*639.2*	*620.5*	*647.0*	*26.5*	*4.2*
Aeronautics	**533.5**	**569.4**	**551.5**	**(17.9)**	**-3.1**
Space Technology	**456.3**	**573.7**	**699.0**	**125.3**	**21.8**
Exploration	**3821.2**	**3712.8**	**3932.8**	**220.0**	**5.9**
Exploration Systems Development	*2982.1*	*3007.1*	*2769.4*	*(237.7)*	*-7.9*
Commercial Spaceflight	*606.8*	*406.0*	*829.7*	*423.7*	*104.3*
Exploration R&D	*232.3*	*299.7*	*333.7*	*34.0*	*11.3*
Space Operations	**5146.3**	**4187.0**	**4013.2**	**(173.8)**	**-4.1**
Space Shuttle	*1592.9*	*556.2*	*70.6*	*(485.6)*	*-87.3*
International Space Station	*2713.6*	*2829.9*	*3007.6*	*177.7*	*6.2*
Space and Flight Support	*839.8*	*800.9*	*935.0*	*134.1*	*16.7*
Education	**145.4**	**136.1**	**100.0**	**(36.1)**	**-26.5**
Cross Agency Support	**2956.4**	**2993.9**	**2847.5**	**(146.4)**	**-4.8**
Center Management &Operation	*2189.0*	*2204.1*	*2093.3*	*(110.8)*	*-5.0*
Agency Management & Operations	*767.4*	*789.8*	*754.2*	*(35.6)*	*-4.5*
Construction & Environmental Compliance	**432.9**	**487.0**	**619.2**	**132.2**	**27.1**
Construction of Facilities	*373.3*	*441.3*	*552.8*	*111.5*	*25.3*
Environmental Compliance	*59.6*	*45.6*	*66.4*	*20.8*	*45.6*
Inspector General	**36.3**	**38.3**	**37.0**	**(1.3)**	**-3.4**
Totals:	**18448.0**	**17770.0**	**17711.4**	**(58.6)**	**-0.3**

Note: In several instances, numbers may not add due to rounding.

The FY13 budget request for NASA is $17.7 billion, a $58.6 million or .3 percent decrease from the FY12 estimate. In FY11, NASA received $18.4 billion; and in FY10, the agency was funded at $18.7 billion. For FY13, NASA is authorized to receive $19.9 billion.

The budget request for NASA's Science Mission Directorate is $4.91 billion, which is $162.5 million less than FY12 level. As expected, the James Webb Space Telescope (JWST) receives a generous increase to reflect the newly established baseline targeting a launch date of October 2018. This resulted from a lengthy re-plan process completed by NASA in 2011 after experiencing extensive cost and schedule overruns. Consistent with the re-plan, JWST would receive $627.6 million, an increase of over 20 percent when compared to the FY12 estimate of $518.6 million.

Earth Science and Heliophysics receive modest increases, and Astrophysics receives a modest decrease. The Planetary Science budget request for FY13, however, is $1.19 billion, a decrease of $309 million or 20 percent from the $1.5 billion FY12 level. In particular, the Mars Exploration Program sees a precipitous drop in funding, declining from $587 million in FY12 to $360.8 million for FY13. The proposed budget effectively ends the planned joint NASA - European Space Agency (ESA) 2016 and 2018 Mars missions. According to NASA, efforts will begin immediately to re-plan the Mars Exploration program in an effort to deliver a new, less-expensive architecture to Congress for consideration by late spring 2012.

NASA's Exploration budget request assumes operation and utilization of the International Space Station through at least 2020 and proposes $3 billion in FY13 for ISS operations, maintenance, research, Soyuz crew transportation and commercial cargo delivery. The budget also requests $71 million for the final disposition of Space Shuttle assets.

NASA's FY13 budget proposes $1.34 billion for the continued development of the Space Launch System, which is 11 percent or $162 million less than the FY12 level. The budget also proposes $1.024 billion for the Orion Multi Purpose Crew Vehicle, which is 14.6 percent or $175 million less than was appropriated in FY12. The NASA Authorization Act of 2010 (P.L. 111-267) articulated Congressional intent that NASA develop the Space Launch System and Multi Purpose Crew Vehicle as soon as possible to ensure U.S. access to the International Space Station in case commercial crew and cargo capabilities fail to materialize. However, under the current program NASA will not have the SLS/MPCV system operational until 2021.

For Commercial Crew Development activities, NASA's FY13 budget proposal diverges from previous Congressional direction by requesting $830 million, which is $424 million or 104 percent more than the FY12 level. NASA asserts that this higher level of annual funding is required in order to develop a commercial crew capability by 2017.

Department of Energy (DOE)

Department of Energy (DOE) Spending
(dollars in millions)

Program	FY11 Actual	FY12 Enacted	FY13 Request	FY13 Request versus FY12 Enacted $	FY13 Request versus FY12 Enacted %
Office of Science*	**4897.3**	**4873.6**	**4,992.0**	**118.4**	**2.4**
Advanced Scientific Computing Research	*410.3*	*440.9*	*455.6*	*14.7*	*3.3*
Basic Energy Sciences	*1638.5*	*1688.1*	*1799.6*	*111.5*	*6.6*
Biological and Environmental Research	*595.2*	*609.6*	*625.3*	*15.8*	*2.6*
Fusion Energy Sciences	*367.3*	*401.0*	*398.3*	*(2.7)*	*-0.7*
High Energy Physics	*775.6*	*790.9*	*776.5*	*(14.3)*	*-1.8*
Nuclear Physics	*527.7*	*547.4*	*526.9*	*(20.4)*	*-3.7*
Energy Efficiency and Renewable Energy (EERE)*	**1771.7**	**1809.6**	**2337.0**	**527.4**	**29.1**
Hydrogen and Fuel Cell Technologies	*95.8*	*103.6*	*80.0*	*(23.6)*	*-22.8*
Biomass and Biorefinery Systems	*180.0*	*199.3*	*270.0*	*70.7*	*35.5*
Solar Energy	*259.6*	*289.0*	*310.0*	*21.0*	*7.3*
Wind Energy	*78.8*	*93.3*	*95.0*	*1.7*	*1.9*
Geothermal Technology	*37.0*	*37.9*	*65.0*	*27.1*	*71.7*
Water Power	*29.2*	*58.8*	*20.0*	*(38.8)*	*-66.0*
Vehicle Technologies	*293.2*	*328.8*	*420.0*	*91.2*	*27.7*
Building Technologies	*207.3*	*219.2*	*310.0*	*90.8*	*41.4*
*Advanced Manufacturing***	*105.9*	*115.6*	*290.0*	*174.4*	*150.9*
Nuclear Energy R&D***	**401.0**	**450.9**	**382.4**	**(68.5)**	**-15.2**
Electricity Delivery and Energy Reliability R&D	**138.2**	**139.1**	**143.0**	**3.9**	**2.8**
Fossil Energy R&D	**434.1**	**346.7**	**420.6**	**73.9**	**21.3**
ARPA-E	**179.6**	**275.0**	**350.0**	**75.0**	**27.3**
Loan Guarantee Program Office	**179.5**	**6.0**	**9.0**	**3.0**	**50.0**
Totals:	**7998.0**	**7892.6**	**8561.1**	**668.5**	**8.47**

*Minor and non-S&T-related accounts at SC and EERE are not shown.
**Formerly known as Industrial Technologies Program.
***Includes Reactor Concepts RD&D, Fuel Cycle R&D, Integrated University Program, LWR SMR Licensing Technical Support, International Nuclear Energy Cooperation's, and Nuclear Energy Enabling Technologies.

The Department of Energy (DOE) funds a wide range of research, development, demonstration, and commercial application activities within the Science, Space, and Technology Committee's jurisdiction.

Office of Science (SC)
The Office of Science (SC) total budget request for FY13 is $5 billion, a $118 million or 2.4 percent increase over the FY12 level. The mission of SC is the "delivery of scientific discoveries and major scientific user facilities and tools to transform our understanding of nature

and to advance the energy, economic, and national security of the United States."[5] SC's responsibilities are in three main areas: selection and management of research; operation of world-class, state-of-the-art scientific facilities; and design and construction of new facilities.

In support of its mission, SC funds basic research through six primary programs: advanced scientific computing, basic energy sciences, biological and environmental research, fusion energy sciences, high energy physics, and nuclear physics. The Basic Energy Sciences (BES) program is proposed to receive the bulk of the overall growth in SC funding, increasing $111 million or 6.6 percent from FY12.

Advanced Research Projects Agency – Energy (ARPA-E)

The Administration request for the Advanced Research Projects Agency – Energy (ARPA-E) is $350 million, a $75 million or 27.3 percent increase over FY12. Established in 2007 by the America COMPETES Act (P.L.110-69), ARPA-E is statutorily charged with developing energy technologies that result in "(i) reductions of imports of energy from foreign sources; (ii) reductions of energy-related emissions, including greenhouse gases; and (iii) improvement in the energy efficiency of all economic sectors." The DOE budget request states that "ARPA-E sponsors specific high-impact transformational research and development projects that overcome the long-term technological barriers in the development of energy technologies to meet the Nation's energy challenges, but that industry will not support at such an early stage. ARPA-E is funding transformational research to create revolutionary technologies that will fuel the economy, create new jobs, reduce energy imports, improve energy efficiency, reduce energy-related emissions, and ensure that the U.S. maintains a technological lead in developing and deploying advanced energy technologies."

Initially provided with $400 million in American Recovery and Reinvestment Act (ARRA) (P.L.111-5) funding, ARPA-E did not receive a direct appropriation in FY10, though it did receive a $15 million transfer from the Office of Science. In FY11 and FY12, ARPA-E received appropriations of $180 and $275 million, respectively. In total, ARPA-E has now issued twelve funding opportunity announcements and funded over 180 projects in energy technology areas such as wind, solar, batteries, biomass, and carbon capture.

DOE budget documents state that in FY13, ARPA-E proposes to "increase the number of programs in two broad areas: Transportation Systems and Stationary Power, with a priority on Transportation Systems including advanced manufacturing and vehicles research and development. Additionally, ARPA-E will continue to build on the already strong cooperative relationship with the U.S. Department of Defense to develop advanced clean energy technologies."[6]

Nuclear Energy

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,

---

[5] Department of Energy, "*Department of Energy FY 2013 Congressional Budget Request: Budget Highlights.*" February 2012. P. 18. Accessible at: http://www.cfo.doe.gov/budget/13budget/Content/Highlights.pdf

[6] *DOE Budget Highlights*, p. 26.

development, and demonstration as appropriate."[7] NE "conducts research and development activities for nuclear energy generation, security, materials, systems, safety, and waste management technologies and tools, and operates and maintains nuclear infrastructure in a safe and compliant manner to support achievement of national energy, climate, and non-proliferation goals."[8]

The FY13 budget request for NE is $770.4 million, a $5.1 million or 0.7 percent increase from FY12 levels. NE's primary R&D programs are Nuclear Energy Enabling Technologies, or NEET, ($65.3 million); Light Water Reactor Small and Modular Reactor Licensing Technical Support ($65 million); Reactor Concepts RD&D ($73.6 million); and Fuel Cycle R&D ($175 million). The NE research accounts total $382.4 million, a $68.5 million or 15.2 percent decrease from FY12. The majority of this decrease is proposed to come out of the Reactor Concepts program (-$41.2 million), including the Next Generation Nuclear Plant (NGNP) (-$19.2 million), advanced small modular reactors (-$9.5 million), and advanced reactor concepts (-$9.5 million).

The budget request consolidates funding previously provided in the Energy and Water Development Appropriation "Other Defense Activities" account into the NE funding line. Thus, the budget requests $95 million for security at NE's primary national research facility, Idaho National Laboratory, as a part of NE, rather than part of "defense activities."

Energy Efficiency and Renewable Energy (EERE)

The Office of Energy Efficiency and Renewable Energy (EERE) supports clean energy research, development, demonstration, and deployment activities on technologies and practices that help achieve national security, environmental, and economical goals in order to meet its mission to "strengthen the United States' energy security, environmental quality, and economic vitality in public-private partnerships."[9]

The Administration requests $2.34 billion for EERE in FY13, a $527.4 million (29.1 percent) increase above FY12 levels. This reflects the President's continued emphasis on "clean energy" programs, as highlighted in recent State of the Union speeches. Many of the EERE programs receive significant proposed increases, such as Geothermal Technologies ($27 million or 71 percent increase), Biomass and Biorefinery RD&D ($70 million or 35.5 percent increase), Advanced Manufacturing, formerly known as the Industrial Technologies Program ($174.4 million or 150.9 percent increase), and Building Technologies ($90.8 million or 41.4 percent increase). The budget request proposes reducing the Hydrogen and Fuel Cell Technology program by $23.6 million or 22.8 percent, and Water Power R&D by $38.8 million or 66 percent.

Electricity Delivery and Energy Reliability

The Office of Electricity Delivery and Energy Reliability (OE) "leads national efforts to modernize the electric grid, enhance security and reliability of energy infrastructure, and

---

[7] Department of Energy, *"Office of Nuclear Energy: Our Mission,"* Accessible at: http://nuclear.energy.gov/neMission.html

[8] *DOE Budget Highlights*, p. 43.

[9] Department of Energy, *"EERE Program Plans, Implementation, & Results."* Accessible at: http://www1.eere.energy.gov/pir/corporate.html

facilitate recovery from disruptions to the energy supply."[10] The FY13 budget request includes $103.4 million for OE R&D, an increase of $4.3 million or 4.3 percent above FY12 enacted levels. OE supports clean energy transmission and reliability, smart grid, and energy storage R&D activities. OE's FY13 budget request proposes a new $20 million "Electricity Systems Hub" to "address the critical issues and barriers associated [with] modernization of the electric grid."[11]

Fossil Energy

The DOE Office of Fossil Energy (FE) supports R&D focused on coal (including clean coal technologies), gas, and petroleum and also oversees the federal government's Strategic Petroleum Reserve. The President's total FY13 budget request for the FE is $650.8 million. Of this amount, $420.6 million is for R&D, an increase of $73.9 million or 21.3 percent from FY12 levels. The FY12 level of $533.7 million included a rescission of $187 million resulting from termination of a major carbon capture and sequestration (CCS) demonstration project funded in a previous fiscal year. The base budget request for FE R&D, before accounting for this rescission, represents a decrease of $113 million, or 21 percent.

Within the FE R&D program, the budget request reduces coal R&D to $275.9 million, a decrease of $92.5 million or 25.1 percent below FY12 levels. The Natural Gas Technologies R&D program request is $17 million, $12 million of which is proposed for a new interagency R&D initiative by DOE, EPA, 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."[12] The Coal and Coal Biomass to Liquids, Solid Oxide Fuel Cells, and Unconventional Fossil Energy Technologies programs are all eliminated in the request.

Energy Innovation Hubs

The FY13 budget request proposes funding six Energy Innovation Hubs throughout various DOE accounts. This includes continuation of five hubs currently funded at levels between $20 and $25 million per year through the SC, EERE, and NE accounts, as well as a newly proposed hub on battery and energy storage to be supported by OE. Energy Innovation Hubs are intended to bring together a multidisciplinary team of researchers to speed research and "shorten the path from scientific discovery to technological development and commercial deployment of highly promising energy-related technologies."[13]

Loan Guarantee Program Office

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.
According to the budget request, the Loan Guarantee Program has awarded over $16 billion in loan guarantees for 26 renewable energy projects, and has made additional commitments that

[10] *DOE Budget Highlights*, p. 32.
[11] Ibid, p. 33.
[12] Ibid, p. 51.
[13] Ibid, p. 6.

have not yet closed totaling over $10 billion. The FY13 budget requests $38 million for administrative operations "to focus on portfolio management and monitoring activities on the existing portfolio as well as originating new loan guarantees to utilize remaining loan authority in the nuclear power, front-end nuclear, fossil, and renewable and energy efficiency sectors." The Administration proposes to offset requested spending with an equivalent amount of fee collections for a net-zero budget request.

National Science Foundation (NSF)

National Science Foundation (NSF) Spending

(dollars in millions)

Account	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Estimate $	FY13 Request versus FY12 Estimate %
Research and Related Activities (RRA)	**5608.4**	**5689.0**	**5983.3**	**294.3**	**5.2**
Biological Sciences (BIO)	*712.3*	*712.4*	*733.9*	*21.5*	*3.0*
Computer and Info. Science and Engineering (CISE)	*636.1*	*653.6*	*709.7*	*56.1*	*8.6*
Engineering (ENG)	*763.3*	*826.2*	*876.3*	*50.2*	*6.1*
Geosciences (GEO)	*885.3*	*885.3*	*906.4*	*21.2*	*2.4*
Mathematical and Physical Sciences (MSP)	*1312.4*	*1308.9*	*1345.2*	*36.2*	*2.8*
Social, Behavioral, and Economic Sciences (SBE)	*247.3*	*254.3*	*259.6*	*5.3*	*2.1*
Cyberinfrastructure (OCI)	*300.8*	*211.6*	*218.3*	*6.6*	*3.1*
International Science and Engineering (OISE)	*49.0*	*49.9*	*51.3*	*1.4*	*2.9*
Polar Programs (OPP)	*440.7*	*435.9*	*449.7*	*13.9*	*3.2*
Integrative Activities (IA)	*259.6*	*349.6*	*431.5*	*81.9*	*23.4*
U.S. Arctic Research Commission	*1.6*	*1.5*	*1.4*	*(0.1)*	*-4.1*
Education and Human Resources (EHR)	**861.0**	**829.0**	**875.6**	**46.6**	**5.6**
Major Research Equipment & Facilities Const (MREFC)	**125.4**	**197.1**	**196.2**	**(0.9)**	**-0.4**
Agency Operations & Award Management	**299.3**	**299.4**	**299.4**	**0**	**0**
National Science Board (NSB)	**4.5**	**4.4**	**4.4**	**0**	**0**
Office of Inspector General (OIG)	**14.0**	**14.2**	**14.2**	**0**	**0**
Totals:	**6912.6**	**7033.1**	**7373.1**	**340**	**4.8**

The FY13 budget request for NSF is $7.4 billion, a $340 million or 4.8 percent increase over the FY12 level. NSF provides over 20 percent of federal support for all basic research at U.S. colleges and universities and is second only to National Institutes of Health (NIH) in support for all academic research. It is the primary source of federal funding for non-medical basic research, providing over 60 percent of all federal support, and serves as a catalyst for science, technology, engineering, and mathematics (STEM) education improvement at all levels of education. The budget for NSF is divided into three main accounts: Research and Related Activities, Education and Human Resources, and Major Research Equipment and Facilities Construction.

Research and Related Activities (RRA)

The FY13 budget request includes over $5.9 billion for Research and Related Activities (RRA), an increase of $294 million or 5.2 percent over FY12. RRA is made up primarily of six

disciplinary directorates: non-biomedical life sciences (BIO); computer sciences (CISE); engineering (ENG); geosciences (GEO); math and physical sciences (MPS); and social, behavioral, and economic sciences (SBE). Each of these directorates receives an increase in the FY13 budget request ranging from 2 percent for SBE to nearly 9 percent for CISE. RRA also houses several NSF Offices, including the Office of Polar Programs which is requesting a 3.2 percent increase, and the Office of Integrative Activities (IA) which is requesting $431 million, a 23 percent increase from FY12.

Beginning in FY13, NSF plans to enable seamless operations across organizational and disciplinary boundaries through a new OneNSF Framework. The OneNSF Framework encompasses a set of currently funded investments to "create new knowledge, stimulate discovery, address complex societal problems, and promote national prosperity."[14] OneNSF Framework priorities for FY13 include: $257 million for Cyber-Enabled Materials, Manufacturing, and Smart Systems (CEMMSS) to transform static systems and processes into adaptive "smart" systems; $106 million for Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21) to address the science-driven integration of cyberinfrastructure; $49 million for Expeditions in Education (E^2) to establish a partnership with EHR and the Department of Education to integrate and expand STEM education research; $19 million for NSF Innovation Corps (I-Corps) to assess opportunities to transition emerging technologies into new products; $63 million for Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) to integrate existing interdisciplinary investments with new Foundation-wide activities; and $110 million for Secure and Trustworthy Cyberspace (SaTC) to align Foundation investments with the national cybersecurity strategy;

OneNSF Framework priorities also incorporate the existing Science, Engineering and Education for Sustainability (SEES) program, which crosses all NSF directorates and has a goal of advancing "climate and energy science, engineering, and education to inform the societal actions needed for environment and economic sustainability and sustainable human well-being." The FY13 budget request for SEES is $202.5 million, an increase of $45.5 million or 29 percent.

The overall budget request for OneNSF Framework activities is $807 million, an increase of $291 million or 56 percent over the FY12 level.

In addition to OneNSF Framework investments, the FY13 NSF RRA budget request also illustrates the manner in which NSF plans to advance all fields of science and engineering and educate the workforce of tomorrow through their portfolio. NSF will continue investments in a number of multifaceted programs, including a $335 million investment in Clean Energy, a $149 investment in Advanced Manufacturing, a $216 million investment in the Faculty Early Career Development program (CAREER), a $243 million investment in the Graduate Research Fellowship program (GRF), and a $158 million investment in the Experimental Program to Stimulate Competitive Research (EPSCoR).

Education and Human Resources (EHR)

The FY13 budget request for Education and Human Resources (EHR) is $845.6 million, a $46.6 million or 5.6 percent increase over the FY12 level and the largest percentage increase for the agency.

---

[14] *FY13 NSF Budget Request to Congress*, p. 3.

Significant increases in the FY13 budget request include $20 million, a $12 million or 150 percent increase over FY12, for the Widening Implementation and Demonstration of Evidence-based Reforms (WIDER)/E^2 program and $20.5 million for a new Expeditions in Education (E^2) initiative to engage, empower, and energize learners in STEM.

The FY13 budget request continues to flat fund the Robert Noyce Scholarship Program (NOYCE) at $54.9 million and decreases funding for the federal Cyber Service: Scholarship for Service/Cybercorps (SFS) program by 44 percent to $25 million. Likewise, the Administration's budget request continues to place a high priority on Graduate Research Fellowships (GRF) by increasing the funding to $121.5 million, a 10.8 percent increase over the FY12 level, while significantly reducing funding for the Integrative Graduate Education and Research Traineeship Program (IGERT) to $22.9 million, a 26.7 percent cut.

Several new or reprogrammed initiatives are to be carried out in conjunction with the Department of Education (ED), OSTP, and other federal science mission agencies to address national priorities in STEM education through a coordinated STEM education investment strategy. The budget request includes three specific NSF EHR collaborations with ED in FY13, including flatlining the NSF Math and Science Partnership (MSP) program at $57 million and aligning it with ED's Effective Teaching and Learning: STEM initiative (formerly ED's MSP program).

The FY13 request also calls for fundamentally reframing the EHR investment portfolio into three categories: Core R&D, Leadership, and Expeditions. The Core R&D investments include four divisions: STEM learning, STEM learning environments, broadening participation and institutional capacity in STEM, and STEM professional workforce preparation. A new $5 million "Core Launch Fund" to allow a first round of grant awards will shape each division. The Leadership investments will focus on the next generation of STEM researchers and educators. And finally, the Expedition investments will be a key component for EHR to partner with other NSF directorates and offices and with the U.S. Department of Education to take on specific challenges over defined periods of time.

Major Research Equipment and Facilities Construction (MREFC)

The FY13 budget request includes $196.2 for the Major Research Equipment and Facilities Construction (MREFC) account. This is a slight 0.4 percent decrease from FY12. The request includes funding for four existing projects: 1) $91 million for the National Ecological Observatory Network (NEON); 2) $25 million for the Advanced Technology Solar Telescope (ATST); 3) $15 million for the Advanced Laser Interferometer Gravitational-Wave Observatory (AdvLIGO); and $65 million for the Ocean Observatories Initiatives (OOI). The IceCube Neutrino Observatory (IceCube) and the Atacama Large Millimeter Array (ALMA) no longer require MREFC funding.

National Institute of Standards and Technology (NIST)

National Institute for Standards and Technology (NIST) Spending

(dollars in millions)

Account	FY11 Actual	FY12 Enacted	FY13 Request	FY13 Request versus FY12 Enacted $	FY13 Request versus FY12 Enacted %
Scientific & Technical Research and Services (STRS)	507.0	567.0	648.0	81.0	14.3
Construction of Research Facilities (CRF)	69.9	55.4	60.0	4.6	8.3
Industrial Technology Services (ITS)	173.3	128.4	149.0	20.6	16.0
Technology Innovation Program (TIP)	*69.9*	*0*	*0*	*0*	*0*
Manufacturing Extension Partnership (MEP)	*124.7*	*128.4*	*128*	*(0.4)*	*-0.3*
Advanced Manufacturing Technology Consortia (AMTech)	--	--	*21.0*	*21.0*	*100.0*
*Baldrige Performance Excellence Program**	*9.6*	*0*	*0*	*0*	*0*
Totals:	750.2	750.8	857.0	106.2	14.1

**in FY11 funded under STRS account*

In FY13, the Administration has requested a funding level of $857 million or a 14.1 percent increase from FY12 funding for the National Institute of Standards and Technology (NIST). The budget request would provide $648 million for NIST's core Scientific and Technical Research and Services (STRS); $60 million for Construction of Research Facilities (CRF); and $149 million for Industrial Technology Services (ITS) programs, including $128 million for the Manufacturing Extension Partnership (MEP) program, and $21 million for the Advanced Manufacturing Technology (AMTech) Consortia Program.

Research and Facilities

The FY13 NIST budget request for Scientific and Technical Research and Services (STRS) is $648 million, an increase of $81 million or 14.3 percent over the FY12 level, and contains an increase of $45 million in measurement science research for advanced manufacturing. The budget request also includes $20 million to establish four competitively selected Centers for Excellence in measurement science areas defined by NIST. Under this program, grants would be awarded to multi or single university centers for five to seven years to provide an interdisciplinary environment where NIST, academic, and industry researchers can collaborate on basic and applied research focused on innovations in measurement science and new technology development.

The FY13 budget request for Construction of Research Facilities (CRF) is $60 million, an 8.3 percent increase over the FY12 level. CRF funding would support maintenance and repair of existing NIST buildings ($48.2 million) as well as continue the interior renovation efforts of Building 1 on the NIST-Boulder campus ($11.8 million).

Industrial Technology Services (ITS)

The FY13 budget request for Industrial Technology Services (ITS) is $149 million, an increase of $20.6 million or 16 percent over the FY12 level.

The $128 million request for the Manufacturing Extension Partnership (MEP) program is a $0.4 million or 0.3 percent decrease from the FY12 level. The MEP program is a public/private partnership run by Centers in all 50 states and Puerto Rico that provides technical assistance for small and medium-sized manufacturers to modernize their operations and adapt to foreign competition. MEP Centers are supported by equal contributions from federal funds, state funds, and industry client fees.

The FY13 budget request includes $21.0 million for the proposed Advanced Manufacturing Technology Consortia (AMTech) Program. This program was also requested in the FY12 budget but did not receive funding. Modeled after the Nanoelectronics Research Initiative (NRI), a partnership between NSF, NIST, industry, and universities across the nation, the AMTech program would establish industry-led consortia to identify and prioritize research projects supporting long-term industrial research needs. The program would provide cost-shared funding to consortia that are focused on developing advanced technologies to address major technical problems that inhibit development and widespread adoption of advanced manufacturing capabilities in the United States.

National Network for Manufacturing Innovation
The FY13 budget request includes a $1 billion proposal to revitalize U.S. manufacturing through the establishment of a National Network for Manufacturing Innovation (NNMI). The NNMI would represent a collaboration between NIST, the Department of Defense, DOE, and NSF to promote the development of manufacturing technologies with broad applications.

Wireless Innovation Fund
In FY13, the Administration has included a plan to invest broadband spectrum auction proceeds in a variety of areas, including providing NIST with up to $300 million for a Wireless Innovation (WIN) Fund to establish a competitive grant program designed to award grants for public safety communications research, development, and demonstration projects. NIST's participation is a piece of the $7 billion National Wireless Initiative included in the American Jobs Act.

National Oceanic and Atmospheric Administration (NOAA)

National Oceanic and Atmospheric Administration (NOAA) Spending
(dollars in millions)

Account	FY11 Actual	FY12 Enacted	FY13 Request	FY12 Request versus FY11 Enacted $	FY12 Request versus FY11 Enacted %
National Ocean Service	487.6	477.8	458.5	(19.3)	-4.0
Oceanic and Atmospheric Research	428.4	386.9	413.8	26.9	7.0
National Weather Service	988.4	997.2	972.2	(25.0)	-2.5
National Environmental Satellite Data Information Service	1,451.7	1,875.0	2,041.4	166.4	8.9
National Marine Fisheries Service	858.7	794.2	807.8	13.6	1.7
Program Support	473.5	431.2	446.6	15.4	3.6
Other Accounts and Financing	38.7	51.7	38.7		
Totals:	**4,727**	**5,014**	**5,179**	**165.0**	**3.3**

The National Oceanic and Atmospheric Administration's (NOAA) budget request for FY13 is $5.2 billion, an increase of $165 million or 3.3 percent above the FY12 level. Unlike the FY12 request, NOAA's FY13 budget request does not include a reorganization or a climate service.

NOAA Line Offices

The FY13 budget request for the National Ocean Service is $458.5 million, a decrease of $19.3 million from the FY12 level of $477.8 million. This amount includes funding for the Integrated Ocean Observing System and the National Centers for Coastal Ocean Science.

The President's request for the Office of Oceanic and Atmospheric Research is $413.8 million, a $26.9 or 7.0 percent increase above the FY12 level. Of this amount, almost $213 million is for climate research activities, and less than $15 million is requested for the weather research program such as advanced radars. It also includes more than $6 million for ocean acidification research.

The FY13 budget request for the National Weather Service is $972.2 million, a $25 million or 2.5 percent reduction from FY12 levels. National Weather Service funding supports warnings and forecasts in addition to the maintenance of weather observation networks.

The President's FY13 request for the National Environmental Satellite, Data, and Information Service is $2,041.4 million, a $166.4 million or 8.9 percent increase above FY12 levels. More than 90 percent of the funding for this line office goes to support the development and deployment of satellites, including the Joint Polar Satellite System (JPSS) and the Geostationary Operational Environmental Satellite system. Although the JPSS program hit a major milestone last October when NOAA launched the first satellite into space, the Agency is still predicting a data gap of up to 18 months before the next satellite will be prepared to launch.

Department of Homeland Security (DHS)

Department of Homeland Security (DHS) Spending

(dollars in millions)

Account	FY11 Actual	FY12 Enacted	FY13 Request	FY13 Request versus FY12 Enacted	
				$	%
Science and Technology Directorate	827.6	668.0	831.5	163.5	24.5
Domestic Nuclear Detection Office	341.7	290.0	328.0	38.0	11.6
Totals:	**1169.3**	**958.0**	**1159.5**	**201.5**	**17.4**

The Science, Space, and Technology Committee has jurisdiction over all R&D within DHS, which is carried out by the Department of Homeland Security Science and Technology Directorate (DHS S&T) and the Domestic Nuclear Detection Office (DNDO). The S&T Directorate, created through language developed by the Science, Space, and Technology Committee in the Homeland Security Act of 2002 (P.L. 107-296), funds research, development, testing and evaluation (RDT&E) to improve homeland security and works to transfer relevant technologies to federal, state and local governments and the private sector. The Domestic Nuclear Detection Office was established by National Security Presidential Directive (NSPD)-43 and Homeland Security Presidential Directive (HSPD)-14 to provide a focal point addressing

nuclear and radiological preventative measures. DNDO is dedicated to both the development and enhancement of the global nuclear detection architecture, the coordination of nuclear detection research and development, and the establishment of procedures and training for end users of nuclear detection equipment.

Science and Technology Directorate
The FY13 budget request for DHS S&T is $831.5 million, an increase of $163.5 million or 24.5 percent from the FY12 level.

The proposed increase is focused on the Research, Development, and Innovation (RD&I) account, which increases by $202.3 million compared to the FY12 estimate. The increase to the RD&I account includes R&D for the DHS operational components as well as increases for S&T's stated priorities: biological threat security ($135.4 million), cybersecurity ($64.5 million), explosives/aviation security ($119.7 million), and first responder technology development ($49.3 million).

The FY13 DHS S&T request reduces the Acquisition and Operations Support account by 37 percent and the Laboratory Facilities account by 26 percent.

Domestic Nuclear Detection Office
The FY13 request of $328 million for the DNDO is a $38 million or 11.6 percent increase from the FY12 level. The funding increase would include support for the Transformational Research and Development (TAR) account at DNDO. In FY11 and FY12, the Administration had proposed transferring the TAR account to the S&T Directorate in order to consolidate all DHS basic research within S&T.

Environmental Protection Agency (EPA)

Environmental Protection Agency (EPA) Spending
(dollars in millions)

Account	FY11 Actual	FY12 Enacted	FY13 Request	FY13 Request versus FY12 Enacted $	FY13 Request versus FY12 Enacted %
Total Agency	8682.1	8449.4	8344.5	(104.9)	-1.2
Science and Technology*	813.5	793.7	807.3	13.5	1.7
Office of Research and Development	581.7	568.0	575.6	7.6	1.3
Superfund R&D	26.8	23.0	23.2	0.2	1.0

*Does not include transfer from Superfund account.

The Environmental Protection Agency (EPA) FY13 budget request for Science and Technology (S&T) programs is $807.3 million, an increase of $13.5 million or 1.7 percent above FY12. The S&T budget request incorporates funding for the Office of Research and Development (ORD) as well as science and technology programs in other line offices. The ORD FY13 budget request of $575.6 million represents an increase of $7.6 million or 1.3 percent above the FY12 level of $568 million. This request includes $14 million in FY13 to conduct an assessment, in coordination with the Department of Energy and the United States Geological Survey, of "potential air, ecosystem, and water quality impacts of hydraulic fracturing."

7. STEM Education across the Federal Government

Federal STEM Education Funding By Agency
(dollars in millions)

Agency	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Estimate $	FY13 Request versus FY12 Estimate %
Department of Agriculture	91	88	91	3	3.5
Department of Commerce	58	55	44	(11)	-20.0
Department of Defense	153	164	153	(11)	-6.7
Department of Homeland Security	2	2	6	4	200.0
Department of Education	561	517	628	111	2.1
Department of Energy	49	48	37	(11)	-22.9
Environmental Protection Agency	20	26	20	(6)	-23.1
Department of Health and Human Services	560	560	554	(6)	-1.1
Department of Interior	1	1	1	-	-
NASA	157	149	117	(32)	-21.5
Nuclear Regulatory Commission	10	16	5	(11)	-68.7
National Science Foundation	1148	1154	1193	39	3.4
Department of Transportation	100	98	101	3	3.1
Totals:	2910	2877	2951	74	2.6

Shading indicates agencies within the Science, Space, and Technology Committee's jurisdiction

The FY13 budget request proposes $3 billion across the federal government for STEM education, a 2.6 percent increase over FY12. Beyond the scope of what is described under the agency sections, Administration priorities also include $775 million for NIH awards to prepare individuals for careers in the biomedical, behavioral, and social sciences; $80 million for training an additional 100,000 effective STEM teachers over the next 10 years through the Department of Education (ED); and $176 million for minority programs at ED, NSF, and NASA.

Pursuant to Sec. 101 of the America COMPETES Reauthorization Act of 2010, the National Science and Technology Council Committee on STEM Education has submitted its first annual report, including an inventory of federal STEM education activities, in conjunction with the FY13 Budget Request. A full 5-year strategic plan is expected in Spring 2012.

The annual report identified $967 million or 28 percent of all federal STEM education funding as being spent on activities that target the specific workforce needs of science mission agencies. The remaining 72 percent of funding is spent on broader STEM education efforts primarily at NSF (47 percent) and ED (40 percent). Of the 252 federally-funded STEM activities identified in the report, none were found to have the same objectives, target audiences, products, or STEM fields of focus. The report acknowledges that "this conclusion should not be interpreted to mean there are no opportunities for improving the alignment, deployment, and efficiency of federal STEM education investments."[15]

[15] *Coordinating Federal Science, Technology, Engineering, and Mathematics (STEM)Education Investments: Progress Report.* Committee on STEM Education, National Science and Technology Council, p. 10.

Chairman HALL. Okay. The Committee on Science, Space, and Technology will come to order. I say good morning to everyone. I know that you know what we are here for. It is entitled "An Overview of the Administration's Federal Research and Development Budget for the Fiscal Year 2013." And in front of you are packets containing the written testimony, biography, and Truth-in-Testimony disclosures for today's witness, Dr. John P. Holdren. I didn't forget the word energy; I just have to recognize myself for five minutes, opening statement.

Dr. Holdren, I certainly want to thank you for appearing with us today. I know it has been a busy week with the late release of the budget just coming out on Monday. As the President's Science Advisor and as Director of the Office of Science and Technology Policy, you are in a unique position to have a real and tangible influence on the Administration's direction in science and technology, so we appreciate you being here to discuss the Administration's R&D priorities and to answer our questions.

Today's hearing obviously will cover a great deal of ground, so I will try to be brief with a few points before we hear from you but we will hear from you shortly. All told, the budget is not much different than your previous budget, so you will understand that my remarks are not much different than the ones I made last year.

Our national debt a year ago was just over $14 trillion dollars. Our debt today is nearly $15.4 trillion dollars, and our national budget deficit has increased by 190 percent between 2008 and 2012. In his three years of office, President Obama has accumulated more debt than every President from George Washington to Bill Clinton combined, and yet the budget we received earlier this week asks for an additional 3.8 trillion, or 23.3 percent of GDP. This level of spending is simply not sustainable, and to be perfectly blunt, it is not creating jobs, growing the economy, or improving the lives of the American taxpayer.

I continue to believe that while it is true that prudent investments in science and technology, including STEM education, will almost certainly yield future economic gains and help create new jobs of the future, it is also true that these gains can be hindered by poor decision-making. Hard-working Americans expect and deserve better. With our unemployment still hovering above eight percent, they expect us to reduce or eliminate these programs that are duplicative and wasteful and examine ways to advance real job creation and economic growth, not just spend their hard-earned money on what the government assumes is best for them. The budget before us today makes a lot of assumptions about what is best for the American taxpayer.

American ingenuity will determine our future. The President said in his recent State of the Union address that "Innovation demands basic research." And he is right; however, blanket increases even for our federal science agencies are not the same as prudent investments and do not guarantee innovation. As stewards of the taxpayers' dollars, we have to curtail runaway spending and prioritize programs that lay the foundation for entrepreneurial success, and we must do that without picking winners and losers.

All of the agencies within the Committee's jurisdiction, with the exception of NASA, receive modest increases in the fiscal year 2013

request. In better economic times, I could support such increases, but even then, I would hope that these investments would be prudently made. The increases in this budget are devoted mainly to new, unproven programs or provide significant increases in those areas that are, in my opinion, making assumptions for the American taxpayer. I remain concerned that a disproportionate amount of the increase to the fiscal year 2013 R&D budget, at least as it pertains to a majority of the agencies within the Committee's jurisdiction, is directed toward climate change, reducing resources available for higher leverage investments. This continued focus for the Federal Government's limited research dollars slows our ability to make innovative and perhaps life-altering advances in other equally, if not more important, disciplines.

The National Science Foundation, DOE's Office of Science, and the National Institute of Standards and Technology, and the National Oceanic and Atmospheric Administration are all funding remarkable research that seeks to improve the way we live our lives. While we should continue to study our changing climate and continue to work toward keeping our air and water clean, we have to closely examine the billions being spent on climate change programs with an eye toward effectiveness. To date, we have already spent $40 billion with absolutely nothing to show for it. We are drowning in red ink, and we need to better prioritize and develop limited R&D dollars to areas that will drive innovation and economic growth.

I also want to reiterate my disappointment with the President's budget as it relates to other energy and environmental policy. The budget doubles down on DOE's expensive and troubled green energy programs while flat funding priority basic research at the Office of Science and cutting R&D aimed at advancing traditional domestic energy exploration and production.

Meanwhile, the President delivers a wink and a nod to EPA as it continues to regulate affordable energy out of existence, often on the basis of shaky and secretive and faulty science. These efforts contribute to higher energy prices throughout the economy and represent misplaced priorities that I hope and expect Congress will reject.

And lastly, with regard to NASA, contrary to the favorable treatment received by the bulk of our government's civil R&D endeavors, NASA seems to have been singled out for unequal treatment. No matter that its top-line number is virtually the same as this year's funding, NASA's science enterprise suffers a 3.2 percent reduction, while the Planetary Sciences taking a grossly disproportionate cut of 20 percent, bringing to a conclusion for the foreseeable future one of the Agency's most exciting and visible science programs.

Further, this budget continues to slow-roll development of a new heavy-lift launch vehicle. The NASA Authorization Act of 2010, signed into law by the President, stipulated that the Space Launch System and the Orion crew capsule be used as a back-up capability for supplying and supporting the International Space Station crew and cargo requirements. Instead, NASA is pacing development of these systems to be operational in 2021, which could occur after International Space Station retirement. America's continued lead-

ership in space, and even our national security, depends in large part on developing and maintaining this critical capability. I cannot stress enough the importance of accelerating the launch system to ensure we have an alternative method to transport people and cargo to ISS as well as the ability to launch missions beyond lower earth orbit.

Dr. Holdren, we remain open to working with you as we move forward but respectfully ask that you take the message back to the President that to say that we continue to have significant concerns with his priorities for our Nation's very precious and limited research and development dollars is a vast understatement.

We thank you and look forward to hearing from you.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF CHAIRMAN RALPH M. HALL

Dr. Holdren, thank you for joining us today. I know it's been a busy week with the late release of the budget just coming out on Monday. As the President's Science Advisor and as Director of the Office of Science and Technology Policy, you are in a unique position to have a real and tangible influence on the Administration's direction in science and technology, so we appreciate you being here to discuss the Administration's R&D priorities and to answer our questions. Today's hearing obviously will cover a great deal of ground, so I will try to be brief with a few points before we hear from you.

All told, this budget is not much different than your previous budget, so you will understand that my remarks are not much different than the ones I made last year.

Our national debt a year ago was just over $14 trillion dollars. Our debt today is nearly $15.4 trillion dollars, and our Nation's budget deficit has increased by 190 percent between 2008 and 2012. In his three years of office, President Obama has accumulated more debt than every President from George Washington to Bill Clinton combined, and yet the budget we received earlier this week asks for an additional $3.8 trillion, or 23.3 percent of GDP. This level of spending is simply not sustainable, and to be perfectly blunt, it's not creating jobs, growing the economy, or improving the lives of the American taxpayer.

I continue to believe that while it is true that prudent investments in science and technology, including STEM education, will almost certainly yield future economic gains and help create new jobs of the future, it is also true that these gains can be hindered by poor decision-making. Hard-working Americans expect and deserve better. With our unemployment still hovering above 8 percent, they expect us to reduce or eliminate those programs that are duplicative and wasteful and examine ways to advance real job creation and economic growth, not just spend their hard-earned money on what the government assumes is best for them. The budget before us today makes a lot of assumptions about what is best for the American taxpayer.

American ingenuity will determine our future. The President said in his recent State of the Union address that "Innovation.demands basic research." And he is right; however, blanket increases even for our federal science agencies are not the same as prudent investment and do not guarantee innovation. As stewards of the taxpayers' dollars, we must curtail runaway spending and prioritize programs that lay the foundation for entrepreneurial success, and we must do that without picking winners and losers.

All of the agencies within this Committee's jurisdiction, with the exception of NASA, receive modest increases in the FY13 request. In better economic times, I could support such increases, but even then, I would demand that those investments be prudently made. The increases in this budget are devoted mainly to new, unproven programs or provide significant increases in those areas that are, in my opinion, making assumptions for the American taxpayer.

I remain concerned that a disproportionate amount of the increase to the FY13 R&D budget, at least as it pertains to a majority of the agencies within this Committee's jurisdiction, is directed toward climate change, reducing resources available for higher leverage investments. This continued focus for the federal government's limited research dollars slows our ability to make innovative and perhaps life-altering advances in other equally, if not more important, disciplines. The National Science Foundation, DOE's Office of Science, the National Institute of Standards and Technology, and the National Oceanic and Atmospheric Administration are all

funding remarkable research that seeks to improve the way we live our lives. While we should continue to study our changing climate and continue to work towards keeping our air and water clean, we must closely examine the billions being spent on climate change programs with an eye toward effectiveness. To date, we have already spent $40 billion with nothing to show for it. We are drowning in red ink, and we need to better prioritize and direct limited R&D dollars to areas that drive innovation and economic growth.

I also want to reiterate my disappointment with the President's budget as it relates to other energy and environmental policy. The budget doubles down on DOE's expensive and troubled green energy programs while flat funding priority basic research at the Office of Science and cutting R&D aimed at advancing traditional domestic energy exploration and production. Meanwhile, the President delivers a wink and a nod to EPA as it continues to regulate affordable energy out of existence, often on the basis of shaky and secretive and faulty science. These efforts contribute to higher energy prices throughout the economy, and represent misplaced priorities that I hope and expect Congress will reject.

And lastly, with regard to NASA, contrary to the favorable treatment received by the bulk of our government's civil R&D endeavors, NASA seems to have been singled out for unequal treatment. No matter that its top-line number is virtually the same as this year's funding, NASA's science enterprise suffers a 3.2 percent reduction, with the Planetary Sciences taking a grossly disproportionate cut of 20 percent, bringing to a conclusion for the foreseeable future one of the agency's most exciting and visible science programs. Further, this budget continues to slow-roll development of a new heavy-lift launch vehicle. The NASA Authorization Act of 2010, signed into law by the President, stipulated that the Space Launch System and the Orion crew capsule be used as a back-up capability for supplying and supporting the International Space Station (ISS) crew and cargo requirements. Instead, NASA is pacing development of these systems to be operational in 2021, which could occur after ISS retirement. America's continued leadership in space, and even our national security, depends in large part on developing and maintaining this critical capability. I cannot stress enough the importance of accelerating this launch system to ensure we have an alternative method to transport people and cargo to ISS as well as the ability to launch missions beyond lower earth orbit.

Dr. Holdren, we remain open to working with you as we move forward, but respectfully ask that you take the message back to the President that to say that we continue to have significant concerns with his priorities for our Nation's precious and limited research and development dollars is a vast understatement.

Chairman HALL. At this time, I recognize Ms. Johnson for her opening statement.

Ms. JOHNSON. Thank you, Mr. Chairman.

Before I begin my statement, I would like to welcome a new Member to the Committee, Suzanne Bonamici, who is from the first district of Oregon. The last Member that occupied that seat was also a Member of this Committee, Mr. Wu. and I want to welcome her.

Now, if you start me back at five because it might take me ten.

Chairman HALL. I will give you the gavel if you ask for it.

Ms. JOHNSON. Well, let me thank you for holding this hearing and I want to welcome Dr. Holdren to the Committee as we take our first look at the President's 2013 R&D budget proposals.

Investments in research and development and STEM education are critical to fostering innovation and maintaining our Nation's competitive edge, but these are also fiscally challenging times, and looking through the President's R&D and STEM education budget, it is noticeable to me that the agencies are trying hard to be more efficient and achieve the most they can with modest increases and in many cases having to absorb cuts. Many of these cuts represent difficult choices and some of us are going to have some disagreements over those choices.

But I commend the President for setting priorities and following through with his R&D budget request. It is imperative to our fu-

ture that we continue to prioritize investments that will advance our knowledge, create new industries and jobs, give our children the grounding in science and technology they will need to succeed in a competitive world economy and improve the quality of life of all of our citizens. I believe that the President's budget really does that.

Having said that, I want to talk a few minutes in which I have some questions. First, I have concerns about some of the funding for the disaster warning, prevention, and mitigation. 2011 was the costliest year ever in terms of economic losses from natural catastrophes. In the United States alone weather in climate-related disasters in 2011 are estimated to have cost us $55 billion. More than a thousand people lost their lives in these weather-related events and an additional 8,000 were injured. The R&D we carry out to insure that our buildings withstand these disasters and our citizens have the information they need to be safe is necessary to protect both lives and property. As of 2011 show these things really do matter.

There is one picture that sticks in my head from the 2008 Hurricane Ike in Galveston and that is a single white house that was still standing after everything around it was destroyed. The owners of that house talked about how they had built it using the latest design and technologies to make their house resilient. These technologies and engineered designs are based on R&D. Much of it is supported by our federal agencies.

I am pleased that NIST's budget request for 2013 prioritizes this area of research. The modest increase in funding proposed by NIST will help communities recover rapidly from natural disasters with minimum loss of life, damage, and business disruption. But we also need to maintain and continue to improve our prediction capabilities and be able to communicate to local authorities when disasters are looming.

I am pleased that NOAA's GOES–R Satellite is getting a substantial increase in its budget to keep it on track for 2015 launch. But I have questions about the small cut to the long-troubled JPSS satellite and how that will affect the program's progress and development of the instruments.

I also worry that the proposal in the budget to close many of these small regional and national weather service offices will hamper communications with local authorities and increase the risk of the loss of life. I hope the Administration will address these concerns before they start to move on any of these plans.

Second, the NASA budget proposes some significant changes and reductions, including to—Mars exploration. I have questions about how the proposed cuts to the Mars science program will affect U.S. leadership and critical capability in landing and operating spacecraft on the surface of Mars. I am also worried about the perception this plan may create that the United States is an unreliable partner in international collaboration and how this might affect the potential for future collaborations. I recognize the fiscal constraints that we are now in, but in some cases, international collaboration is the best way to both maintain U.S. leadership and get the most out of our investments.

Finally, let me say a few words about STEM education. In December, Dr. Holdren, you sent us an inventory of federal investments in STEM education. It is the most comprehensive such inventory we have seen and it has been very helpful and we thank you for that.

Earlier this week, we received a preliminary report on a federal strategic plan for STEM education. I am also very happy to see good progress on the strategic plan that we asked for in COMPETES. But in the meantime, this budget will propose significant cuts to the STEM education budgets of several of our science agencies. Without the detailed strategic plan to point to, I worry that these cuts lack sufficient justification. Our science agencies contain a wealth of intellectual capital and research infrastructure that can and have inspired, attracted, and educated students and the public in STEM for generations. We need to make some tough choices and we need to make some wise choices. Let us just make sure we can clearly justify all of those choices.

We will have some concerns and disagreements but let me be clear. This is a good budget for research, innovation, and education under our circumstances. I look forward to working with the President and my colleagues on both sides of the aisle in the months ahead to come. We need to make sure that the appropriations this Congress will eventually pass properly reflect the need to invest in our future.

I want to thank you, Mr. Hall, for holding this hearing and thank Dr. Holdren for being here today. And I yield back.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF RANKING MEMBER EDDIE BERNICE JOHNSON

Thank you, Chairman Hall, for holding this hearing and welcome, Dr. Holdren, to the Committee as we take our first look at the President's FY 2013 R-and-D budget proposals.

Investments in research and development and STEM education are critical to fostering innovation and maintaining our nation's competitive edge. But these are also fiscally challenging times. In looking through the President's R-and-D and STEM education budget, it is noticeable to me that the agencies are trying hard to be more efficient and achieve the most they can with modest increases and in many cases, having to absorb cuts.

Many of these cuts represent difficult choices and some of us are going to have some disagreements over those choices, but I commend the President for setting priorities and following through in his R-and-D budget request.

It is imperative to our future that we continue to prioritize investments that will advance our knowledge, create new industries and jobs, give our children the grounding in science and technology they will need to succeed in a competitive world economy, and improve the quality of life of our citizens. And I believe the President's budget does just that.

Having said that, I want to talk about a few areas in which I have some questions.

First, I have concerns about some of the funding for disaster warning, prevention, and mitigation. 2011 was the costliest year ever in terms of economic losses from natural catastrophes.

In the United States alone, weather and climate related disasters in 2011 are estimated to have cost us $55 billion. More than 1000 people lost their lives in these weather-related events and an additional 8,000 were injured.

The R-and-D we carry out to ensure that our buildings withstand these disasters and our citizens have the information they need to be safe is necessary to protect both lives and property. As 2011 showed, these things really matter.

There's one picture that sticks in my head from the 2008 Hurricane Ike in Galveston, and that's of a single white house still standing after everything else around

it was destroyed. The owners of that house talked about how they had built it using the latest designs and technologies to make their house resilient.

Those technologies and engineering designs are based on R-and-D, much of it supported by our federal agencies. I am pleased that NIST's budget request for FY 2013 prioritizes this area of research. The modest increase in funding proposed by NIST will help communities recover rapidly from natural disasters with minimal loss of life, damage, and business disruption.

But we also need to maintain and continue to improve our prediction capabilities, and be able to communicate to local authorities when disasters are looming. I am pleased that NOAA's GOES-R satellite is getting a substantial increase in this budget to keep in on track for a 2015 launch.

But I have questions about the small cut to the long-troubled JPSS satellite and how that will affect the program's progress and development of the instruments.

I also worry that the proposal in the budget to close many of the small regional National Weather Service offices will hamper communication with local authorities and increase the risk for loss of life. I hope the Administration will address these concerns before they start to move on any of these plans.

Second, the NASA budget proposes some significant changes and reductions, including to Mars exploration. I have questions about how the proposed cuts to the Mars science program will affect U.S. leadership and critical capability in landing and operating spacecraft on the surface of Mars.

I'm also worried about the perception this plan may create that the United States is an unreliable partner in international collaboration and how this might affect the potential for future collaborations. I recognize the fiscal constraints that we are in now, but in some cases international collaboration is the best way to both maintain U.S. leadership and get the most out of our investments.

Finally, let me say a few words about STEM education. In December, Dr. Holdren, you sent us an inventory of Federal investments in STEM education. It is the most comprehensive such inventory we have seen, and it has been very helpful, so thank you.

Earlier this week we received a preliminary report on a federal strategic plan for STEM education. I am also very happy to see good progress on the strategic plan that we asked for in COMPETES.

But in the meantime, this budget would propose significant cuts to the STEM education budgets of several of our science agencies. Without the detailed strategic plan to point to, I worry that these cuts lack sufficient justification.

Our science agencies contain a wealth of intellectual capital and research infrastructure that can and have inspired, attracted, and educated students and the public in STEM for generations. We need to make some tough choices, and we need to make some wise choices. Let's just make sure we can clearly justify all of those choices.

We will have some concerns and disagreements, but let me be clear. This is a good budget for research, innovation, and education under the circumstances. I look forward to working with the President and my colleagues on both sides of the aisle in the months ahead to make sure that the appropriations this Congress will eventually pass properly reflect the need to invest in our future.

Thank you Dr. Holdren for being here today and thank you for your contributions to ensuring continued U.S. leadership in science and technology.

Chairman HALL. We thank you for your good statement.

And I want, on behalf of the Republican side here, to welcome Ms. Bonamici and I know we will have your assignments worked out to your satisfaction and look forward to working with you.

If there are Members who wish to submit additional opening statements, your statements of course will be added to the record at this point.

And at this time, I would like to introduce our witness, a good, honorable man, Dr. John Holdren is President Obama's Science Advisor, Director of the White House Office of Science and Technology Policy and Co-Chair of the President's Council of Advisors on Science and Technology.

Prior to joining the Administration, he taught at Harvard and was Director of the Woods Hole Research Center. As our witness certainly should know, spoken testimony is limited to five minutes,

but you are the Committee today and we won't put the time on you. We thank you for your very valuable time. We know it takes time from things you need to do; it takes time to be here and to plan your speech for us and then to give it to us and then answer questions. That is asking a lot of you. But each of us will have five minutes to each ask questions and ask you to hold your statements to as close to five or ten minutes as you can do so. Dr. Holdren, I recognize you at this time.

STATEMENT OF DR. JOHN P. HOLDREN, ASSISTANT TO THE PRESIDENT FOR SCIENCE AND TECHNOLOGY AND DIRECTOR OF THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY (OSTP)

Dr. HOLDREN. Well, Chairman Hall and Ranking Member Johnson, Members of the Committee, I thank you for inviting me to testify today on the Civilian Science and Technology components of the President's fiscal year 2013 budget.

The President in his most recent State of the Union Address called on all of us to help create an American economy that is built to last. He called on us to work toward an America that leads the world in educating its people, that attracts a new generation of high-tech manufacturing and high-paying jobs, and that takes control of its own energy. The President's 2013 budget reflects those aims. It includes continuing investment in science and engineering research, as well as science, technology, engineering, and mathematics education—the kinds of investments that have long been at the core of America's capacity to innovate, to prosper, and to remain secure.

A detailed description of the President's 2013 R&D budget has been provided in my written testimony, and in these brief remarks I will only hit a few highlights. The budget proposes $140.8 billion for federal R&D. That is a 1.4 percent increase over fiscal year 2012 enacted in current dollars. I will be using current dollars for all my comparisons here but you can easily convert to constant dollars if you like using the projected rate of inflation from 2012 to 2013 which is 1.7 percent.

Within the $140.8 billion total, the budget proposes about $65 billion for nondefense R&D. That is an increase of five percent over the 2012 enacted level. As you know, the R&D total fits within an overall discretionary budget that would be flat at 2011 enacted level for the second year in a row consistent with the Budget Control Act agreed to by Congress and the President last August. To get there, we had to make some tough choices.

Even aside from defense, which saw decreases in applied research and in development, not all of the science and technology agencies got increases. But those that did included the three agencies that have been identified by this Congress and other distinguished groups as especially important to the Nation's continued economic leadership. The National Science Foundation, the primary source of support for academic research in most non-biomedical disciplines, got a 4.8 percent increase to $7.4 billion. The DOE Office of Science went up 2.4 percent to $4.6 billion, and the NIST laboratories, which play a huge role in U.S. innovation and industrial competitiveness by supporting research and laboratory facilities in

advanced manufacturing and in other critical domains went up 13.8 percent to $708 million.

The 2013 NASA budget of $17.7 billion essentially flat with last year is consistent with the bipartisan agreement between Congress and the Administration that balances the Agency's several crucial missions. The budget funds continue development of the Heavy-Lift Space Launch System and the Orion Multipurpose Crew Vehicle to enable human exploration missions beyond Earth orbit. It also funds the operation and enhanced use of the International Space Station, the development of private sector systems to carry cargo and crew into low Earth orbit, a balanced portfolio of Earth and space science, including a continued commitment to new satellites and programs for Earth observation, a dynamic space technology development program, and a strong aeronautics research effort. It also continues support for a scheduled 2018 launch of the James Webb Space Telescope.

The President's budget also proposes to expand, simplify, and make permanent the Research and Experimentation tax credit in order to spur private investment in R&D and it maintains momentum to enlist the private sector in our economic renewal through such programs as the Startup America Partnership, a nonprofit alliance of successful business owners, major corporations, and service providers. The budget also addresses the overarching importance of STEM education by investing $3 billion in STEM ed programs across the Federal Government, a 2.6 percent increase guided by a soon-to-be-released STEM education strategic plan that shows the way to cutting back on lower priority programs to make room for targeted increases in the programs that work best.

In summary, this Administration has presented a budget aimed at insuring that America remains at the center of the global revolution in scientific research and technological innovation. I look forward to working with this Committee to make the vision of that budget proposal a reality. And I will be happy to try to answer any questions that the Members may have.

Thank you very much.

[The prepared statement of Mr. Holdren follows:]

Statement of Dr. John P. Holdren
Director, Office of Science and Technology Policy
Executive Office of the President of the United States
to the
Committee on Science, Space and Technology
United States House of Representatives
on
Research and Development in the President's Fiscal Year 2013 Budget
February 17, 2012

Chairman Hall, Ranking Member Johnson, and Members of the Committee, it is my distinct privilege to be here with you today to discuss the civilian science and technology components of the President's fiscal year (FY) 2013 Budget.

Administration Initiatives in Innovation, Education, and Infrastructure

President Obama, in his most recent State of the Union address, called on all of us to help create an American economy that is built to last. He called on us to work toward an America within our reach: A country that leads the world in educating its people. An America that attracts a new generation of high-tech manufacturing and high-paying jobs. An America in control of our own energy. He called on us all to do what this Nation does best – investing in the creativity and imagination of the American people. In order to be globally competitive in the 21st century and create an American economy that is built to last, we must not only put this Nation on a sustainable fiscal path, but also create an environment where invention, innovation, and industry can flourish.

The President's 2013 Budget does exactly that. It includes continuing investment in science and engineering research that can turn ideas into realities. And it provides support for the creation of new technologies, products, businesses, and industries that, despite barely having been imagined a few years ago, promise to become essential and even iconic.

The 2013 Budget recognizes today's difficult economic circumstances and makes tough choices, limiting spending in many areas that in other times would be deemed worthy of greater support. But the Budget also focuses on and shows confidence in the future. By building and fueling America's engines of discovery, it will expand the frontiers of human knowledge, promote sustainable economic growth based on a revitalized American manufacturing sector, cultivate an American clean-energy future, improve health-care outcomes for more people at lower cost, address global climate-change challenges, manage competing demands on environmental resources, and reinforce our national security. This Budget is designed to ensure that America will continue, in the President's words, to "out-innovate, out-educate, and out-build the rest of the world."

As past budgets from this Administration did, the President's new 2013 Budget proposes to invest intelligently in innovation, education, and infrastructure today to generate the industries, jobs, workforce, and environmental and national-security benefits of tomorrow. Obviously, we need the continued support of the Congress to get it done. I say "continued support" because much of the President's Federal research and education investment portfolio enjoyed bipartisan support during the first three years of the Administration. We hope to extend

this partnership, with both the Senate and the House, across the entire science and technology portfolio.

In the remainder of this testimony, I elaborate on the reasons the Administration is most hopeful you'll provide that support.

The Federal R&D Budget

In his State of the Union address, the President outlined a vision of working together to create an economy built on American manufacturing, American energy, and skills for American workers. We can help spur innovation to accomplish these goals by investing in research and development. The President's Fiscal Year 2013 Budget proposes $140.8 billion for Federal research and development (R&D) to do just that—to build American innovation in manufacturing, to promote clean American energy, and to nurture a highly skilled American workforce for the future. To strengthen U.S. leadership in the 21st century's high-tech, knowledge-based economy within difficult budget constraints, the 2013 Budget proposes a substantial increase in non-defense R&D to $64.9 billion, an increase of 5.0 percent over the 2012 enacted level.

(My testimony discusses changes in current dollars, not adjusted for inflation. The latest economic projections show inflation of 1.7 percent between 2012 and 2013 for the economy as a whole, using the GDP deflator.)

This five percent increase notwithstanding, the Obama Administration's investments in innovation, education, and infrastructure fit within an overall discretionary budget that would be flat at 2011 enacted levels for the second year in a row, consistent with the Budget Control Act agreed to by Congress and the President last August. The Budget reflects strategic decisions to focus resources on those areas where the payoff for the American people is likely to be highest, while imposing hard-nosed fiscal discipline on areas lacking that kind of promise. For example, the $74.1 billion proposed for development in the 2013 Budget represents a decline compared to the 2012 funding level. Across government, important programs will have to make do with less, as noted in several of the program descriptions below. And the Administration's commitment to making tough choices is not limited to development funding. The total (defense and nondefense) R&D budget would be $140.8 billion, 1.4 percent above the 2012 enacted level but well below the $142.7 billion enacted total for fiscal year 2011.

Budgets of Science Agencies

Three agencies have been identified as especially important to this Nation's continued economic leadership by the President's Plan for Science and Innovation, the America COMPETES Act of 2007, the Administration's Innovation Strategy, and the America COMPETES Reauthorization Act of 2010 enacted last January. Those three jewel-in-the-crown agencies are the National Science Foundation (NSF), a primary source of funding for basic curiosity-driven academic research which leads to discoveries, inventions, and job creation; the Department of Energy's (DOE's) Office of Science, which leads fundamental research relevant to energy and also builds and operates much of the major research infrastructure—advanced light sources, accelerators, supercomputers, and facilities for making nano-materials—on which our scientists depend for research breakthroughs; and the National Institute of Standards and Technology (NIST) laboratories, which support a wide range of technically and economically

essential pursuits from accelerating standards development for health information technology to conducting measurement-science research to enable net-zero-energy buildings and advanced manufacturing processes.

In recognition of the immense leverage these three agencies offer and their key role in maintaining America's preeminence in the global marketplace, Congress and this Administration have worked together to put total funding for these agencies on a doubling trajectory. New funding levels set in the Budget Control Act of 2011 mean delaying the original target completion date for doubling these budgets. But the 2013 Budget maintains the doubling commitment with a 4.3 percent increase between 2012 and 2013 for the three agencies' combined budgets, totaling $13.1 billion. I want to emphasize that the proposed increases for these agencies are part of a fiscally responsible budget focused on deficit reduction, meaning these increases are fully offset by cuts in other programs.

I now turn to the budgets of individual agencies in a bit more detail. I will focus on the agencies under the jurisdiction of the Committee. Therefore, I will not provide details of the defense R&D portfolio (the Department of Defense and DOE's defense programs) or the budget of the National Institutes of Health (NIH).

National Science Foundation (NSF)

The National Science Foundation (NSF) is the primary source of support for academic research for most non-biomedical disciplines, and it is the only Federal agency dedicated to the support of basic research and education across all fields of science and engineering. NSF has always operated under the belief that optimal use of Federal funds relies on two conditions: ensuring that its research is aimed – and continuously re-aimed – at the frontiers of understanding; and certifying that every dollar goes to competitive, merit-reviewed, and time-limited awards with clear criteria for success. When these two conditions are met, the Nation gets the most intellectual and economic leverage from its research investments. In recognition of the time-proven truth that today's NSF grants are tomorrow's job-creating companies, the 2013 Budget request for NSF is $7.4 billion, an increase of 4.8 percent above the 2012 funding level.

NSF puts the greatest share of its resources into the Nation's colleges and universities. Universities are the largest performers of basic research in the United States, conducting over 50 percent of all basic research. Basic research funding such as that provided by NSF is important not only because it leads to new knowledge and applications but also because it trains the researchers and the technical workforce of the future, ensuring the Nation will benefit from a new generation of makers and doers. In order to maximize this dual benefit to society and NSF's special contribution, the 2013 Budget provides $243 million to sustain the number of new NSF Graduate Research Fellowships at 2,000. The 2013 Budget also includes $64 million for the Advanced Technological Education (ATE) program to promote partnerships between higher-education institutions and employers to educate technicians for the high-technology fields that drive our nation's economy.

The 2013 Budget expands NSF's efforts in clean-energy research, advanced manufacturing, wireless communications, cyberinfrastructure, and other emerging technologies. NSF proposes to increase research funding to promote discoveries that can spark innovations for tomorrow's clean-energy technologies with a cross-disciplinary approach to sustainability science. The Science, Engineering, and Education for Sustainability (SEES) portfolio will

increase to $203 million in the 2013 Budget for integrated activities involving renewable energy technologies, green chemistry, and complex environmental and climate processes. NSF supports job creation in advanced manufacturing and emerging technologies with $257 million in Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS) for multidisciplinary research targeted at new materials, smart systems, advanced manufacturing technologies, and robotics technologies. To encourage interdisciplinary research for the bioeconomy of the future, the 2013 Budget provides $30 million for research at the interface of biology, mathematical and statistical sciences, the physical sciences, and engineering in the BioMaPS program. The Cyberinfrastructure Framework for 21st Century (CIF21) portfolio will expand to $106 million in the 2013 budget for accelerating research, workforce development, advanced computing infrastructure, and new functional capabilities in computational and data-enabled science and engineering. The Budget proposes $51 million for the NSF's Enhanced Access to the Radio Spectrum, or EARS, to support research into new and innovative ways to use the radio spectrum. NSF also proposes $110 million for Secure and Trustworthy Cyberspace (SaTC), a cybersecurity basic research initiative.

National Aeronautics and Space Administration (NASA)

The 2013 NASA Budget reaffirms the Administration's commitment to a bold and ambitious future for NASA, consistent with the bipartisan agreement between Congress and the Administration regarding the importance of NASA and its many programs. These critical efforts not only advance grand and inspirational undertakings such as space exploration, scientific discovery, and aeronautical research, but also provide an indispensable platform from which to study and understand our planetary home. Moreover, NASA's programs drive new technology development and innovation and help advance new products, services, businesses, and jobs with great potential for economic growth. In keeping with such considerations and the provisions of the 2010 NASA Authorization Act (the Act), the 2013 Budget funds continued development of the Space Launch System (SLS) and Orion Multi-Purpose Crew Vehicle (MPCV) to enable human-exploration missions beyond Earth's orbit; the operation and enhanced use of the International Space Station (ISS), which has been extended through at least 2020; the development of private-sector systems to carry cargo and crew into low Earth orbit, thus re-establishing a U.S. human spaceflight capability and shortening the duration of our sole reliance on Russian launch vehicles for access to the ISS; a balanced portfolio of space and Earth science, including a continued commitment to new satellites and programs for Earth observation; a dynamic space-technology development program; and a strong aeronautics research effort.

Within the context of a difficult budget environment and the Budget Control Act's spending caps freezing discretionary spending at 2011 levels for the second year in a row, NASA's budget request for 2013 is $17.7 billion, a decrease of $88 million from the 2012 enacted level. This budget incorporates difficult choices that honor the priorities of the Act while providing a balanced program of science, research, technology development, safe spaceflight operations, and exploration. The budget for the James Webb Space Telescope (JWST) is $628 million in 2013 in support of a scheduled 2018 launch, thus assuring NASA the opportunity to continue work on this transformative facility, which will expand and deepen our understanding of how the first stars and galaxies formed after the Big Bang, planets around other stars and dark energy. The budget for Mars exploration reflects an integrated strategy that ensures the next steps for the robotic Mars Exploration Program that support science and long-term human exploration goals. The 2013 Budget maintains Earth-science research funding levels consistent with the 2012 Budget. The Budget also provides $1.9 billion in FY 2013 funding for the SLS

and $1.0 billion for the Orion MPCV, advancing the continued development of these systems that will enable exploration to deep-space destinations beyond today's reach. In these activities NASA will build on the configuration and acquisition decisions that it has made over the last several months. Similarly, the Budget provides a solid foundation for the commercial crew and cargo transportation programs that are necessary to provide safe and cost-effective U.S. access to low Earth orbit, and will allow us to stop paying Russia for astronaut transport to the ISS.

Department of Commerce National Institute of Standards and Technology (NIST)

The hugely complex web of technology that keeps this Nation's equipment and economy running smoothly depends on largely invisible but critical support in the fields of measurement science and standards. The National Institute of Standards and Technology (NIST) laboratories stand at the core of this Nation's unparalleled capacity in these areas, promoting U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology. Reflecting NIST's vital role in supporting the economy and infrastructure, the 2013 Budget of $708 million for NIST's intramural laboratories and construction of research facilities amounts to a 13.8 percent increase over the 2012 enacted level. That increase will support high-performance laboratory research and facilities for a diverse portfolio of investigations in areas germane to advanced manufacturing, nanotechnology, cybersecurity, and disaster resilience. For NIST's extramural programs, the Budget includes $128 million for the Hollings Manufacturing Extension Partnership and $21 million for the Advanced Manufacturing Technology Consortia program, a new public-private partnership that will develop road maps of long-term industrial research needs and will fund research at leading universities and government laboratories directed at meeting those needs. The Budget also proposes $300 million in mandatory NIST funding for a Wireless Innovation (WIN) Fund to develop standards, technologies, and applications to support the development of an interoperable broadband network for first responders. All of these NIST programs are important components of *A National Strategy for Advanced Manufacturing*, a comprehensive strategic plan to guide Federal advanced manufacturing R&D investments that will be released this month.

Department of Commerce National Oceanic and Atmospheric Administration (NOAA)

NOAA plays a vital role supporting research on the Earth's oceans, atmosphere, and marine habitats which directly and indirectly are enormous sources of economic activity. The NOAA budget of $5 billion allows NOAA to strengthen the scientific basis for environmental decision-making; improve critical weather and climate services that protect life and property; invest more heavily in restoring our oceans and coasts to ensure their ongoing ecological stability and commercial vigor; and ensure satellite continuity.

The 2013 Budget provides $1.8 billion to continue the development and acquisition of NOAA's polar-orbiting and geostationary weather satellite systems, as well as satellite-borne measurements of sea level and potentially damaging solar storms. The Budget includes funding to continue work on the instruments and spacecraft for the Joint Polar Satellite System, or JPSS. NOAA will also conduct Arctic research (including bellwether studies of changing conditions), improve regional projections of climate change, and support research on coastal and marine resources and development of marine sensor technologies to address harmful algal blooms and ocean acidification.

Department of Energy (DOE)

The Department of Energy (DOE) 2013 Budget positions the United States to lead in the clean-energy economy of the future with an R&D portfolio that totals $11.9 billion, an increase of $884 million or 8.0 percent over the 2012 enacted level. (This does not include DOE's non-R&D cleanup, weapons, and energy-deployment programs.) The Administration's clean-energy R&D priorities focus on developing cutting-edge technologies with real-world applications to advance a clean-energy economy, increase energy efficiency in industry and manufacturing, reduce energy use in buildings, and reach the goal as soon as possible of having 1 million advanced technology vehicles on the road.

The 2013 Budget invests in DOE's clean-energy programs to reduce dependence on oil and to move toward a clean-energy future, including $2.3 billion for Energy Efficiency and Renewable Energy (EERE). Within this total, the Budget provides $290 million to expand activities on innovative manufacturing processes and advanced materials to enable U.S. companies to cut manufacturing costs by using less energy. The Budget also moves closer to the goal of 1 million advanced technology vehicles on the road by investing $420 million within EERE to advance vehicle technologies and to make electric vehicles cost competitive, and by enhancing advanced vehicle tax incentives. The Budget also includes $12 million for DOE as part of a $45-million priority research and development initiative by the Department of Energy, the Department of the Interior's U.S. Geological Survey, and the Environmental Protection Agency to understand and minimize the potential environmental, health, and safety impacts of natural gas development through hydraulic fracturing (fracking).

The 2013 Budget provides $350 million for the Advanced Research Projects Agency – Energy (ARPA-E) within DOE to support transformational discoveries and accelerate solutions in the development of clean energy technology. ARPA-E performs high-risk, high-reward energy research with real-world applications in areas ranging from grid technology and power electronics to batteries and energy storage. First funded as part of the American Recovery and Reinvestment Act (ARRA), ARPA-E is a signature component of the America COMPETES Act, and was reauthorized in the America COMPETES Reauthorization Act of 2010.

The 2013 Budget also supports research through Energy Innovation Hubs funded in 2012 to solve specific energy challenges as part of DOE's overall research and development strategy. Each of the five Energy Innovation Hubs focuses top scientific and engineering talent on a specific problem: improving batteries and energy storage, reducing constraints from critical materials, developing fuels that can be produced directly from sunlight, improving energy-efficient building systems design, and using modeling and simulation for advanced-nuclear-reactor operations. The Budget proposes $20 million to create a new Energy Innovation Hub on Electricity Systems to focus on grid systems, emphasizing the interface between transmission and distribution systems. Each of these Hubs will bring together a multidisciplinary team of researchers in an effort to speed research and shorten the path from scientific discovery to technological development and commercial deployment of highly promising energy-related technologies. Complementing the Hubs, the Department plans to continue coordination with the Office of Science's Energy Frontier Research Centers, which tackle the toughest scientific hurdles to building a new 21st century clean energy economy.

The Department of Energy's Office of Science pursues fundamental discoveries and supports major scientific research facilities that provide the foundation for long-term progress in

energy-related domains such as nanotechnology, the physical sciences, advanced materials, high-end computing, energy supply and end-use efficiency, and climate change. The Office stewards 10 DOE National Laboratories and supports the research of more than 25,000 Ph.D. scientists, graduate students, and postdoctoral associates at over 300 universities and national laboratories nationwide. More than 27,000 researchers from academe, national laboratories, and industry make use of its advanced scientific user facilities each year, pursuing discoveries at the frontiers of science that enhance the Nation's energy security and strengthen our economic competitiveness. The 2013 Budget of $5.0 billion for the Office of Science, 2.4 percent above the 2012 enacted level, provides support for facilities and cutting-edge research.

Environmental Protection Agency (EPA)

Environmental Protection Agency (EPA) R&D funding totals $576 million in the 2013 Budget, $8 million more than the 2012 funding level. With this investment, EPA will focus on enhancing and strengthening the planning and delivery of science in its restructured research and science programs, making these efforts more integrated and cross-disciplinary. The 2013 Budget supports high-priority research of national importance in such areas as potential endocrine disrupting chemicals, innovative chemical design, green infrastructure, computational toxicology, drinking water, and STEM fellowships. The 2013 Budget proposes a total of $14 million for EPA for the above-mentioned collaboration with USGS and DOE on hydraulic fracturing.

United States Geological Survey (USGS)

The total budget of the United States Geological Survey (USGS), Interior's lead science agency, is $1.1 billion, a $35 million increase from the 2012 enacted level. The 2013 Budget proposes $19 million for USGS for the above-mentioned collaboration with EPA and DOE on hydraulic fracturing. The Budget also sustains USGS funding for water and ecosystems science programs; research to mitigate natural hazards such as earthquakes, landslides, floods, and volcanoes; and climate change science.

Department of Homeland Security (DHS)

Department of Homeland Security (DHS) R&D totals $729 million in the 2013 Budget, up 26.3 percent from the 2012 enacted level in order to partially restore steep cuts enacted in 2012 appropriations. The 2013 Budget funds important R&D advances in cybersecurity, nuclear materials and explosives detection, and biological response systems. The Budget does not fund construction of the National Bio- and Agro-Defense Facility (NBAF) in 2013; rather, DHS will conduct a comprehensive reassessment of the need for and cost of such a laboratory.

Department of Transportation (DOT)

The 2013 Budget provides $1.1 billion for Department of Transportation (DOT) R&D, a $132 million increase compared to the 2012 funding level. The Budget request includes funding for several R&D activities in the Federal Aviation Administration's (FAA) Next Generation Air Transportation System, known as NextGen. The Joint Planning and Development Office coordinates this important effort, which strives to reduce delays, expand capacity, and improve the safety and environmental impact of air transportation. The Federal Highway Administration (FHWA) also manages a comprehensive, nationally coordinated highway research and

technology program, engaging and cooperating with other highway research stakeholders. FHWA performs research activities associated with safety, infrastructure preservation and improvements, and environmental mitigation and streamlining.

White House Office of Science and Technology Policy (OSTP)

The 2013 Budget requests $5.85 million for White House Office of Science and Technology Policy (OSTP) operations, above the $4.50 million 2012 enacted funding level but 12.0 percent below the $6.65 million 2011 enacted funding level. OSTP works with the Office of Management and Budget (OMB) to set S&T priorities for all the executive branch departments and agencies with S&T and STEM-education missions. OSTP also provides science and technology advice and analysis in support of the activities of the other offices in the Executive Office of the President and supports me in my role as the Assistant to the President for Science and Technology, with the responsibility to provide the President with such information about science and technology issues as he may request in connection with the policy matters before him. In addition, OSTP coordinates a wide array of interagency research initiatives with significant economic implications through administration of the National Science and Technology Council (NSTC) and serves as the lead White House office in a range of bilateral and multilateral S&T activities internationally. This work is accomplished with approximately 27 full-time equivalent staff supported by the OSTP appropriation, which includes the OSTP Director, four Associate Directors (for Science, Technology, Environment, and National Security and International Affairs), additional technical experts, and a small administrative team. In addition, there are approximately 50 scientific and technical experts detailed to OSTP from all across the executive branch along with approximately a dozen other experts brought in under the Intergovernmental Personnel Act or various fellowship arrangements. This mix of personnel allows OSTP to tap a wide range of expertise and leverage a multitude of high-value resources to ensure that the science and technology work of the Federal government is appropriately supported, coordinated and amplified. The reduced 2012 OSTP funding level required significant reductions in staffing and support levels; the 2013 Budget would return OSTP personnel and support funding closer to historical levels.

Interagency Initiatives

A number of priority interagency S&T initiatives are highlighted in the President's 2013 Budget. These initiatives are coordinated through the NSTC, which as noted above is administered by OSTP.

Networking and Information Technology R&D

The multi-agency Networking and Information Technology Research and Development (NITRD) provides strategic planning for and coordination of agency research efforts in cyber security, high-end computing systems, advanced networking, software development, high-confidence systems, information management, and other information technologies. The 2013 Budget provides $3.8 billion for NITRD, an increase of $69 million over the 2012 funding level. This initiative is celebrating its 20th anniversary this month.

Networking and computing capabilities are more critical than ever for a range of national priorities, including supporting national and homeland security, reforming the healthcare system, understanding and responding to environmental stresses, increasing energy efficiency and

developing renewable energy sources, strengthening the security of our critical infrastructures including cyberspace, and revitalizing our educational system for the jobs of tomorrow. The 2013 Budget includes a focus on research in an area of ever-growing importance: how best to derive value and scientific inferences from unprecedented quantities of data. It also continues to emphasize foundations for assured computing and secure hardware, software, and network design and engineering to address the goal of making Internet communications more secure and reliable.

National Nanotechnology Initiative

The 2013 Budget provides $1.8 billion for the multi-agency National Nanotechnology Initiative (NNI), an increase of $70 million over the 2012 funding level. Research and development in the NNI focuses on the development of materials, devices, and systems that exploit the fundamentally distinct properties of matter at the nanoscale—on the order of a billionth of a meter—and on environmental and health studies relating to nanomaterials. NNI-supported R&D is enabling breakthroughs in disease detection and treatment, manufacturing at or near the nanoscale, environmental monitoring and protection, energy conversion and storage, and the design of novel electronic devices. Participating agencies continue to support fundamental research for nanotechnology-based innovation, technology transfer, and nanomanufacturing through individual investigator awards; multidisciplinary centers of excellence; education and training; and infrastructure and standards development, including openly-accessible user facilities and networks. Furthermore, agencies have identified and are pursuing Nanotechnology Signature Initiatives in the national priority areas of nanomanufacturing, solar energy, and nanoelectronics through close alignment of existing and planned research programs, public-private partnerships, and research roadmaps.

The NNI agencies are guided by two strategic documents developed by the Nanoscale Science, Engineering, and Technology Subcommittee of the NSTC. The 2011 NNI Strategic Plan aligns nanoscale science and technology research with the NNI's four goals and includes specific, measurable objectives for each goal. The 2011 NNI Environmental, Health, and Safety Research Strategy delineates a research and implementation framework that will produce the information necessary to protect public health and the environment, foster product development and commercialization, and consider the ethical, legal, and societal issues associated with nanotechnology development.

U.S. Global Change Research Program

The Budget includes an expanded commitment to global change research, with the understanding that insights derived today will pay off with interest in the years and decades ahead as our Nation works to limit and adapt to shifting environmental conditions. Investments in climate science over the past several decades have contributed enormously to our understanding of global climate. The trends in global climate are clear, as are their primary causes, and the investments in this research arena in the 2013 Budget are a critical part of the President's overall strategy to mitigate U.S. greenhouse-gas emissions and move toward a clean-energy economy even as we adapt to those changes that are inevitable. Specifically, the 2013 Budget provides $2.6 billion for the multi-agency U.S. Global Change Research Program (USGCRP)—an increase of 5.6 percent or $136 million over the 2012 enacted level—to continue its important work of improving our ability to understand, predict, mitigate, and adapt to global change, including but not limited to climate change.

The USGCRP was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606) to improve understanding of uncertainties in climate science, expand global observing systems, develop science-based resources to support policymaking and resource management, and communicate findings broadly among scientific and stakeholder communities. Thirteen departments and agencies participate in the USGCRP. OSTP and the Office of Management and Budget (OMB) work closely with the USGCRP to establish research priorities and plans to maximize research-dollar efficiencies and ensure that the program is aligned with the Administration's priorities and reflects agency planning.

The 2013 Budget supports the four objectives set forth in USGCRP's new decadal strategic plan, to be released within the next few weeks, which are to (1) Advance Science: advance scientific knowledge of the integrated natural and human components of the Earth system; (2) Inform Decisions: provide the scientific basis to inform and enable timely decisions on adaptation and mitigation; (3) Conduct Sustained Assessments: build sustained assessment capacity that improves the United States' ability to understand, anticipate, and respond to global change impacts and vulnerabilities; and (4) Communicate and Educate: advance communications and education to broaden public understanding of global change.

Funding in the 2013 Budget will support an integrated and continuing National Climate Assessment of climate-change science, impacts, vulnerabilities, and response strategies, as mandated by Congress.

Innovation, Entrepreneurship, and Job Creation

In addition to the investments in R&D I have described, the President's 2013 Budget targets strategic investments to spur innovation in the public and private sectors and to maximize the impact of the Federal R&D investment for innovation, with the goal of transforming the Nation's economy and improving the lives of all Americans.

The Budget proposes a permanent extension of the research and experimentation (R&E) tax credit to spur private investment in R&D by providing certainty that the credit will be available for the duration of the R&D investment. The 2013 Budget proposes to expand and simplify the credit as part of making it permanent.

The 2013 Budget sustains the Administration's effort to promote regional innovation clusters as significant sources of entrepreneurship, innovation, and quality jobs. These efforts are taking place in several agencies working together, including the Small Business Administration (SBA), DOE, and especially the Economic Development Administration (EDA) within the Department of Commerce. EDA will be pursuing several programs in research parks, regional innovation clusters, and entrepreneurial innovation activities, as authorized in the America COMPETES Reauthorization Act. And as mentioned earlier, the 2013 Budget continues to support the Hollings Manufacturing Extension Partnership (MEP) in NIST to disseminate the latest advanced manufacturing techniques and innovative processes to small- and medium-sized manufacturers around the Nation. It also supports an expansion of NSF's Innovation Corps (I-Corps) program with $19 million to bring together technological, entrepreneurial, and business know-how to move research discoveries toward commercialization. Taken together, these investments will help ensure that Federal investments in innovation, education, and infrastructure translate into commercial activity, real products, and jobs.

That is why the Obama Administration believes that leadership across the frontiers of scientific knowledge is not merely a cultural tradition of our nation, but is also an economic and national security imperative. This Administration wants to ensure that America remains at the epicenter of the global revolution in scientific research and technological innovation that promises to generate new knowledge, create new jobs, and build new industries.

I look forward to working with this Committee to make the vision of the President's FY2013 Budget proposal a reality. I will be pleased to answer any questions the Members may have.

White House Science Fair, calling for the United States to establish a goal of training one million additional STEM graduates over the next decade. Federal agencies will contribute to this goal through programs designed to engage students and improve teaching and learning in STEM fields from early learning through K-12 and undergraduate levels. For example, the 2013 Budget proposes a significant boost in funding at NSF for undergraduate education, and improved coordination between undergraduate STEM education programs at NSF and ED. The Budget proposes $61 million for NSF's Transforming Undergraduate Education in STEM (TUES) program, which will provide research and development funds to design, test, and implement more effective educational materials, curriculum, and methods to improve undergraduate learning and completion rates in STEM for a diverse population. The Budget also proposes $60 million for a jointly administered NSF and ED mathematics education initiative that will allocate funds for early research, development, validation, and scale-up of effective practices. Similar to ED's Investing in Innovation (i3) program, this initiative will support collaborations between researchers and practitioners to develop and test promising approaches and support widespread adoption of practices found to be effective through rigorous evaluations.

These efforts are part of a broader Administration commitment to look carefully at the effectiveness of all STEM programs and find ways to improve them. To further this goal, last year I established a Committee on STEM Education under the NSTC. In December, the Committee released the most comprehensive inventory of all Federal STEM efforts ever compiled. The work of this Committee is closely aligned with the vision for STEM education outlined by Congress in the America COMPETES Reauthorization Act and has focused on improving the coordination and effectiveness of all Federal STEM education programs. In this spirit, the Administration released a description of a 5-year Federal STEM education strategic plan and an update to the Federal STEM inventory along with the Budget. The final strategic plan, to be released this spring, will outline a path to increase coordination and collaboration among the 13 agencies that support STEM education and increase the efficiency and impact of the Federal portfolio of STEM education programs.

OSTP looks forward to working with this Committee on our common vision of improving STEM education for all of America's students.

Clean Energy

The Administration intends for the United States to lead the world in research and development of clean-energy technology to help reduce dependence on oil and other energy imports and to mitigate the impact of climate change while creating high-paying, high-skilled clean energy jobs and new businesses. The Budget reflects the Administration's comprehensive strategy on clean energy, which starts with basic and applied research to address some of the fundamental unknowns to advancing clean energy technologies, such as developing advanced light-weight, ultra-strong materials; followed by research and development to create clean energy products, like solar panels, batteries and electric vehicles, wind turbines, and modular nuclear reactors; and then providing appropriate assistance to American entrepreneurs to commercialize the technologies that will lead the world in new clean energy technology.

The Budget dedicates nearly $6.7 billion to clean energy research, development, demonstration, and deployment to help accelerate the transition to a low-carbon economy and position the United States as the world leader in clean energy technology. This increase of about $760 million is 13 percent above the 2012 enacted level.

21st Century Infrastructure

In his State of the Union address, the President established a vision of rebuilding America for the 21st century. This vision is reflected in the 2013 Budget in investments that will not only rebuild roads and bridges but will also help build the new infrastructure needed for America to remain competitive in this century.

To build the infrastructure the U.S. needs to compete globally in the 21st century, to spur innovation in the public and private sectors, and to provide the foundational capacities that facilitate the growth of new jobs and industries, the 2013 Budget proposes to bring next-generation, wireless broadband Internet to all Americans; to invest in R&D for a smart, energy-efficient, and reliable electricity delivery infrastructure; and to build a 21st century aviation system.

The Budget proposes to invest $300 million from expected spectrum auction proceeds for a Wireless Innovation (WIN) Fund to accelerate the research and development of cutting-edge wireless technologies and applications, as part of the effort to support an interoperable public safety broadband network. This will enable businesses to grow faster, students to learn more, and public safety officials to access state-of-the-art, secure, nationwide, and interoperable mobile communications. The Budget also proposes incentive auction authority and other spectrum reforms to foster the conditions for the next generation of wireless technology, nearly doubling the amount of wireless spectrum for mobile broadband.

Conclusion

This Administration's 2013 Budget reflects a clear understanding of the critical importance of science and technology, STEM education, and 21st century infrastructure to the challenges the Nation faces. Recognizing the importance of responsibly reducing projected budget deficits and holding the line on government spending, the Administration has made disciplined choices in order to maintain and in some cases increase critical investments that will pay off by generating the American jobs and industries of the future—all in the context of a discretionary budget that stays flat for a second year in a row. Indeed, the science and technology investments in the 2013 Budget are essential to keep this country on a path to revitalized economic growth, real energy security, intelligent environmental stewardship, better health outcomes for more Americans at lower costs, strengthened national and homeland security, and continuing leadership in space.

As this Committee has long emphasized, the best environment for innovation in all technologies is a broad and balanced research program for all the sciences. Such a broad base of scientific research will provide the foundation for a cornucopia of multidisciplinary discoveries—some expected and planned, others entirely unexpected—with enormous benefits for our society. This country's overall prosperity in the last half century is due in great measure to America's "innovation system"—a three-way partnership among academia, industry, and government—and that same partnership will allow us to maintain that prosperity in the decades to come.

That is why the Obama Administration believes that leadership across the frontiers of scientific knowledge is not merely a cultural tradition of our nation, but is also an economic and national security imperative. This Administration wants to ensure that America remains at the epicenter of the global revolution in scientific research and technological innovation that promises to generate new knowledge, create new jobs, and build new industries.

I look forward to working with this Committee to make the vision of the President's FY2013 Budget proposal a reality. I will be pleased to answer any questions the Members may have.

Chairman HALL. Thank you, sir. And I thank you for your testimony and remind all Members that the Committee rules limit questioning to five minutes. And at this time I will open with the questions and I will stay with the five minutes. We are on a close schedule today and our witness' time is valuable and we are going to try not to delay the meeting if we have a vote. If somebody will take the Chair, I will go vote and come back. We will work that out as we go.

I recognize myself for five minutes and I will stay within the five minutes.

Dr. Holdren, NASA recently announced its intent to use Space Act Agreements for the next round of funding for the Commercial Crew Program, and I know you are familiar with that, aren't you? And I know that you are as anxious as anybody or probably more so than most folks for the safety standards. But I have a problem with this. Under these agreements it is my understanding that NASA can't require the companies to meet any safety standards. I don't know how that could have been left out but how does the Agency intend to insure that these vehicles ultimately are going to be safe enough to take NASA astronauts to the International Space Station alone?

Dr. HOLDREN. Well, Chairman Hall, it is my understanding that NASA retains the responsibility for ensuring the safety of its astronauts whether the launches are commercial or government launches. I am not familiar with the level of detail in these particular agreements that you are referring to, but I can't imagine that NASA does not retain that responsibility and that ability, and if there is a problem in the agreements that would jeopardize that, I am sure we will fix it.

Chairman HALL. We will look closely at that. NASA as you know has to acquire assistance from the companies they deal with and a close reading of that escapes us if they can require the companies to meet any safety standards, but it is logical that they would. And we may address that to you later and would thank you. And I thank you for your answer to that and I understand it.

In light of NASA's decision to draw from the joint Mars mission with the European Space Agency in 2016 and 2018, I find your statement a little bit puzzling when you said "the budget for Mars exploration reflects an integrated strategy that ensures the next step for the Robotic Mars Exploration Program that support science and long-term human exploration goals." Since we don't have any apparent next mission to Mars, just what do you mean by that statement?

Dr. HOLDREN. Well, first of all, Mr. Chairman, I think we retain—notwithstanding deciding that we do not have the budget to go forward with the 2016 and 2018 joint missions with the European Space Agency, we retain the most vigorous and forward-leaning Mars exploration program that there has ever been, the most forward-leaning in the world. We have a surface rover on Mars at the moment. We have the most sophisticated surface rover ever dispatched. The Mars Science Laboratory, en route, was launched in November, will land in August, is the size of an SUV. We have two satellites in orbit around Mars at this moment collecting the most extraordinary data, including recently a remarkable set of im-

ages showing a landslide on Mars; a capability to observe that has never before existed. We have a 2013 mission to Mars Atmosphere and Volatile Evolution or MAVEN mission on the schedule and additional missions going forward.

So I think we are in no way retreating from our commitment to have a vigorous program of Mars exploration, including laying the groundwork for human exploration.

Chairman HALL. We want to certainly keep our work in space and we want to keep our access to our space station, and we feel endangered there by the lack of any certainty as to when we are going to go back there but we almost know we are going to do that and yet keep alive some hope for Mars, but I don't see anything written that is stamped that we are going back to Mars anytime, have any program part other than a desire to. And we can't spend any money going back to Mars. People can't spend money to go to the grocery store, so the economy is going to pretty well instruct you and the President and those of us who support those missions. And I hope you agree with that.

Dr. HOLDREN. Mr. Chairman, the economy obviously has to remain priority one in this budget and going forward. We all understand that, but we also, as the President pointed out in his State of the Union message, cannot afford to neglect the investments in science, technology, innovation, and exploration that are going to be the basis of our future capabilities and our future leadership around the world. We are proposing to spend in this budget $1.88 billion for the heavy-lift launch system, one of whose purposes is to enable missions beyond low Earth orbit, including missions to an asteroid as the President has described and eventually a mission to Mars. And that is in the budget statements that Mars remains our eventual destination with these capabilities. There is another billion dollars for the multi-mission crew vehicle which again has in mind those deep space missions.

Chairman HALL. I thank you for that and I know you are available for future questions even if by mail. I have gone several seconds over my five minutes.

I now recognize Ms. Johnson for her five minutes of questioning.

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

Dr. Holdren, you have done quite a bit of work on the mandated STEM inventory and we are to receive the rest of it soon. Now, in the meantime, the Administration's budget for 2013 request includes 20 percent cuts in STEM education and activities at a number of our agencies, including NASA and NOAA, EPA, and DOE. How do we justify these cuts while the strategic planning process is still underway? I know that we have to be very frugal but I am worried about being penny wise and pound foolish. Can you comment on that a bit?

Dr. HOLDREN. Yes, I can, Ranking Member Johnson. First of all, as you point out, we did do an extraordinarily thorough inventory of the STEM education programs and what they contain. We will be releasing shortly the full STEM education strategic plan and the Congress will have that available as it ponders its own conclusions about the budget. But we relied very heavily on the information developed in that inventory and in the preparation of the plan in making our decisions across the STEM ed domain.

As I have already indicated, we had really tough choices to make because under the overall constraints of budget discipline that are required, we obviously not only couldn't increase everything; we had to cut some things to make room for increases in others. And what we tried to do is we tried to look for the highest leverage where an additional dollar could make the biggest contribution. Those are tough choices to make but we believe that the education programs that we propose to scale back have been less effective than the education programs that we propose to scale up. And that was the basis of the decisions. And I hope after you see the STEM education strategic plan that you will agree with us.

Ms. JOHNSON. Well, thank you. Now, one other question. The satellites for weather and many other things really does protect and give warning, save lives. Do you think that we have the capability with this budget to maintain our solar satellite program and continue with our forward activity of protecting our public and keeping information readily available for our skies?

Dr. HOLDREN. Well, first of all, we in the Administration completely agree with you that these polar orbiting satellites for weather forecasting and climate monitoring, hurricane tracking are absolutely crucial, and we have been threatened for some time, in a gap that we inherited, with the possibility that the existing polar satellites will end their useful lifetime before the replacements are up there. We are doing everything possible to try to be sure that at very least we minimize that gap even if we don't now have the capability to avoid it altogether.

Last year, we didn't get as much money appropriated as we requested those satellites. Neither did we get as much money as we asked for the previous year, and those gaps are hurting us. We are trying to make up for it in this year's budget, and one of the reasons that NOAA's R&D budget has gone down in the President's proposal is precisely to make room for more money for those satellites to minimize that gap because this is absolutely crucial. And again it underlines the tough choices we had to make. Nobody wanted to reduce other aspects of the R&D portfolio at NOAA but we absolutely have to minimize the gap in coverage by the satellites.

As you point out, they are crucial among other things to minimize the damage from extreme weather events by providing information to people that enable them to make preparations.

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

Chairman HALL. Thank you, Ms. Johnson.

We now recognize Members for their questions. We will start with Mr. Rohrabacher, the gentleman from California, for five minutes.

Mr. ROHRABACHER. Thank you very much.

And thank you very much for being with us today. These discussions are always enlightening. Although we have some major disagreements, we can do so amicably. And I will start with one question that is not maybe such a major disagreement.

I notice that the budget request for the DOD's R&D budget request is 11.9 billion and Secretary Chu says that 770 million of that will go for nuclear energy. Those of us who think that nuclear energy should be playing a major role would suggest that might be

less money than what would be—less money than compared to other energy resources that we think are a little more esoteric. But I would like to talk to you specifically about that nuclear energy request.

Sixty million dollars is intended for nuclear waste R&D that would go along with the Blue Ribbon Commission report which we had a hearing on here not too long ago. And, you know, it has been said that waste is our only resource that we are not smart enough to use yet, and I believe that that pertains directly to all of this "nuclear waste" that we are confronted with. Well, there are several companies that are working right now on transformational fast neutron reactors. Toshiba's 4S reactor, GE has a thing, prism reactor, and General Atomics has what they call the EM2. All of these can be used—waste as fuel and burn up to 97 percent more of the material. Well, the Blue Ribbon Commission of course sat here and talked to us about how they were supportive of spending billions of dollars to put waste in a hole. I would like to know are we going to be spending some of our resources to help develop this new technology rather than putting things in a hole that will help build this technology that can actually burn this waste and put it to good use and providing electricity—safe electricity for the American people?

Dr. HOLDREN. Well, Congressman Rohrabacher, I always enjoy our friendly interactions. This is a very complicated topic. We could spend the rest of the hearing talking about it, but let me make just a few points.

Mr. ROHRABACHER. All right.

Dr. HOLDREN. One is I think the Department of Energy's budget for nuclear energy research is commensurate both with the promise and with the fact that nuclear energy is in many respects already a mature industry in the private sector. And you mentioned a number of the companies involved in cutting edge work there. The private sector does a lot of the work, as it should, in a domain that is this well developed.

The second point I would make is I think all of us, my colleagues and I in OSTP, Secretary Chu and DOE are very interested in the potential of advanced nuclear energy technologies such as the type you mentioned.

Mr. ROHRABACHER. But are you interested in it enough to make sure it is funded as compared to some of these other as I say more esoteric——

Dr. HOLDREN. Well, again I think the government's funding in this domain is appropriate given both the promise and given the role of the private sector which is large. But I would also point out that when you talk about burning nuclear waste, this doesn't actually avoid the problem of ultimately having to put something in the ground. And the reason is that these fast neutron reactors burn the heavy isotopes in the nuclear waste——

Mr. ROHRABACHER. Right.

Dr. HOLDREN. —which to be sure have the longest half-lives. It is beneficial to burn those and get the energy benefit from them. But one still ends up with a rich array, if you will, of fission products——

Mr. ROHRABACHER. Right.

Dr. HOLDREN. —that do have to be disposed of.

Mr. ROHRABACHER. This just makes the problem a lot smaller. And I would suggest that this be something that if we do end up disagreeing on this after some non-hearing discussions, I would suggest that that might be something that we will have to push from this side on because this issue is too important just to talk about putting things in holes, which we could do years ago.

And finally, Mr. Chairman, as I have just a few seconds left, let me be on the record as I am very concerned about Vice President Biden's statement yesterday that we should speed up the transfer of technology to China, which is—I have no idea that the Vice President could say something as stupid that but he did and I am very interested in finding out whether or not that is the policy of this Administration.

Thank you very much.

Chairman HALL. I come to the gentleman's rescue. The gentleman's time has expired so you don't have to answer that right now, Dr. Holdren.

Do you insist on answer?

Mr. ROHRABACHER. It would be nice if he could answer that.

Chairman HALL. Can you answer that with a yes or a no?

Dr. HOLDREN. I will try to be approximate and brief.

Chairman HALL. All right.

Dr. HOLDREN. I have not spoken with the Vice President about the particular statement but certainly there are some technologies where it is in our interest to share with China. We cooperate with China, for example, on influenza. That enables us to get more advanced warning of flu epidemics and to develop vaccines. We have shared technology with China on nuclear reactor safety because a nuclear reactor accident in China would be to our detriment as well as theirs, and there are certainly a number of domains in which it is in our national interest to help China address problems that are our problems, too.

Chairman HALL. All right. The gentleman's time has expired.

We also gave China our canal down there. The former President did, that's my recollection.

Recognize Mr. Lipinski at this time for five minutes.

Mr. LIPINSKI. I thank you, Mr. Chairman. I want to thank Dr. Holdren for his service. It is an important role especially in these tough budget times.

I want to first ask about—a question about the weather service. NOAA provides a severe weather and climate forecast that saves lives and property across the country every year. We all know the important job that they do. While I understand the tough choices that had to be made in this time of fiscal constraint, it concerns me that within the NOAA budget request, the National Weather Service line is one of the few line offices receiving a budget decrease. I am not sure this is a correct priority considering the increase in extreme weather that our country has experienced recently. So in these tight economic times, how does the Administration plan to balance the need to invest in promising innovations without sacrificing everyday essentials like the services provided by the National Weather Service?

Dr. HOLDREN. I would say for some of the details on that question I would want to consult Administrator Lubchenco, but I would

note that, first of all, what is crucial for the National Weather Service to do its job are the basic data coming from observations of what the atmosphere is doing. And if we cannot find the money to support the satellites from which those data come, then all the money in the world poured into the Weather Service won't make up for the deficit. And again, I think part of the challenge in NOAA has been notwithstanding now a couple of years of appropriations falling short of what we thought was needed for the polar orbiting satellites. We are now trying to make up for that gap.

But I also think that we are doing more in promoting symbiosis and synergism among the different components of Earth observation, satellite monitoring and so on among NASA, NOAA, the USGS. And if you look at the budget for the Global Change Research Program which brings together all of those capacities with 13 agencies participating, it is increasingly focused on providing the sort of information that firms and individuals, businesses, farmers need in order to anticipate and respond to extreme weather events and climate change. So we are trying to do more in that domain overall.

Mr. LIPINSKI. I can appreciate the need to put the funding in for—to get the data. I think we just also need to be careful that we have the people on the ground who—and the offices on the ground to do what we need with that data.

I want to take the rest of my time to move on to another issue and that is prize competition. As you know, the COMPETES Reauthorization included a prize competition initiative based in part on a GENIUS Act I introduced with Representative Frank Wolf. Last year, you told me you were enormously enthusiastic about the potential prizes and I was pleased to see the launch of Challenge.gov to highlight and promote this initiative. How has this new authority been used over the past year?

Dr. HOLDREN. Well, first of all, we remain enormously enthusiastic about prizes and we have now authorized all of the departments and agencies to use competitions and prizes to achieve their goals, to advance their priorities. And——

Mr. LIPINSKI. Is there anything new on the horizon that you can talk about?

Dr. HOLDREN. Well, in fact we have a full-time person in OSTP who does nothing but work with the agencies on prizes and competitions. And there is a bunch of stuff in the pipeline. I mean it would—again it would take the rest of this hearing to talk about all of the prize and competition activity that is going on, but I think this is one of the richest and most productive domains of getting more for less. And I thank you, Congressman Lipinski, for your role in pushing this forward. It is simply an enormous high-leverage opportunity and we are exploiting it.

Mr. LIPINSKI. I appreciate that and I like to have the opportunity since I have only have 30 seconds left—I won't be able to go into this more—but to discuss more with you where this is going and where the different agencies are taking this. But with that I will thank you and yield back the balance of my time.

Chairman HALL. Thank you, Mr. Lipinski.

The Chair at this time recognizes the gentleman from Oak Ridge, Mr. Fleischmann, from Tennessee, five minutes.

Mr. FLEISCHMANN. Thank you, Mr. Chairman.

Welcome, Dr. Holdren. I have a question in regard to the—actually two-part question in regard to fiscal year 2013. The R&D budget details efforts to strengthen our Nation's competitiveness and long-run economic growth. My first question, sir, is what is the Administration doing to measure and evaluate the economic impacts of basic research funding? And my second question, sir, is what methods can the Federal Government use to prioritize funding areas of basic research both within the area of science and across areas of science?

Dr. HOLDREN. Congressman Fleischmann, those are really tough questions as you know. We have been working on the STAR METRICS program to develop ways to better measure the effectiveness of our investments in research and development, but you mentioned in particular basic research. It is very easy to measure the success of basic research long after the fact such as the NSF grants to two Stanford graduate students named Brin and Page who subsequently, on the basis of the research they did, founded Google, which now has $64 billion in annual revenue and employs 20,000 people. So we can look back and say, "gee, that was a great investment in basic research but it is the character of basic research," that at the time you are funding it and the time you are doing it, you have no real idea what the benefits are going to be.

And so we have to continue to rely, as we always have, on the competitive peer review process to try to identify the most exciting, interesting, and promising domains of basic research; but we are never going to be able to quantify in advance rather than retrospectively what is going to work versus what doesn't. And at the same time I would say it is not stopping us from trying to get better through the STAR METRICS effort at understanding what works best in the way we go about prioritizing research.

Your other question has to do with cross-agency, cross-department, cross-topic prioritization, and all I can say there in the brief time available, again, is that we try to think about it in terms of the greatest bang for the buck. Where will an additional dollar do the most good, relatively speaking? But it is fundamentally a very, very difficult task. And as you know, what actually emerges, emerges from an interplay between the Administration and the Congress that somehow integrates divergent views on where the leverage is.

Mr. FLEISCHMANN. Thank you. Mr. Chairman, I yield back.

Chairman HALL. I thank you, and at this time we recognize Mr. McNerney, gentleman from California, for five minutes.

Mr. MCNERNEY. Thank you, Mr. Chairman.

Dr. Holdren, you mentioned work on public-private partnerships and innovation in entrepreneurship. Would you be able to give an estimate as to how many jobs have been created by these startups say over a specific period of time like a year or so?

Dr. HOLDREN. The short answer is at this time I would not. I am reluctant to make particular claims about numbers of jobs. I think those tend to be very squishy. You know, I think the data indicate certainly that we are moving in the right direction, but I think it is too soon—although my colleague Alan Krueger, the Chairman of the Council of Economic Advisors, might be able to come up with

a number. At this point I cannot. I will check with him and if he has got a number, we will certainly submit it following the hearing.

Mr. MCNERNEY. And you feel that the current budget proposal has enough resources to continue that progress in the jobs creation?

Dr. HOLDREN. I think it does, yes.

Mr. MCNERNEY. Thank you. Dr. Holdren, one of the greatest technical assets available to the Nation is the capability to maintain bio-national laboratories. The national laboratories such as Sandia National Laboratories and Lawrence Livermore National Laboratory in California do provide a tremendous amount of expertise in areas critical like cyber security, high-performance computing and modeling, biosciences, and so on. Given the technical capabilities at the labs, do you see opportunities for leveraging the federally funded research and development centers to provide technical support to the Administration and other government agencies?

Dr. HOLDREN. The short answer is absolutely yes. The national laboratories are enormous resources, sources of discovery, invention, and innovation. We have many programs that are trying to beef up and accelerate the flow of ideas and prospective products from research universities and national laboratories into the private sector and into the marketplace. The energy innovation hubs that the Secretary of Energy initially proposed and have now been funded in considerable measure include linking national laboratories, research universities, and firms to get this translation done. And we need to do more of it.

Mr. MCNERNEY. Are you concerned about the capabilities of these labs considering possible future budget and funding?

Dr. HOLDREN. Congressman, I am concerned about the health of all of our R&D ecosystem, and in fact the President's Council of Advisors on Science and Technology, which I Co-Chair, is in the late stages of a study of what we need to do to maintain the quality of that R&D ecosystem across our country. And that includes the national labs, the research universities. It includes the pipeline from schools and community colleges to firms and enterprises. I think we have to be very attentive to the health of this enterprise and we have to make the investments or the sources of innovation that we are going to need aren't going to be there.

Mr. MCNERNEY. Well, I thank you for that answer and I share your concern.

Dr. Holdren, this Committee has held several hearings on the safety of hydraulic fracturing. Does the budget in your opinion have enough resources devoted to research in this area to help address the growing public concerns about possible contamination of deep water supplies?

Dr. HOLDREN. Congressman, the FY 2013 budget includes the proposal of the President to include $45 million for an interagency R&D initiative aimed at exactly those questions. That's a 150 percent increase over the 2012 enacted level. The research will be coordinated among the Department of Energy, the U.S. Geological Survey, and the EPA. We are convinced that this resource can be exploited safely, but we have to make the investments to be sure that is the way it happens, because if we don't ensure that it is in

fact developed safely with appropriate attention to the quality of our water supplies, among other environmental values, then the public is not going to let it happen. And we need that resource so we need to do it right and we are determined to do it right.

Mr. MCNERNEY. Thank you for that answer.

I yield back.

Chairman HALL. The Chair at this time recognizes Mr. Hultgren, the gentleman from Illinois, for five minutes.

Mr. HULTGREN. Thank you, Mr. Chairman.

Dr. Holdren, one of my many constituent physicists recently reminded me that science comes in two forms. I like the way that he put this. He said that two forms of science are Edisonian science, the application of scientific principles to build stuff; and the Einsteinian science, the effort to discover the basic principles themselves. Our system of free enterprise does a very good job at the Edisonian science—Apple, General Electric, Intel, IBM are all examples of that. And since World War II, the United States has been a global leader in the public investment and Einsteinian science as well. But I am deeply troubled by the President's budget request as it seems to be quite a pronounced departure from this half-century legacy of American leadership in fundamental research, especially when high-energy physics has made major concessions, in particular closing down the Tevatron.

BES received $110 million of the increase where all other programs in Department of Science received 8 million—110 million to $8 million. I wonder, do you think that is an equitable distribution, particularly when Fermilab was cut by eight percent in the President's budget request in the midst of an important transition to define a new vital U.S. role in particle physics? If you think this is equitable, I want to know what your plans are for Fermilab.

Dr. HOLDREN. Congressman Hultgren, the concept of equitable is a difficult one to apply in making tough choices among competing scientific priorities. Again, we have gotten tremendous benefit out of Fermilab. We have gotten tremendous benefit out of the Tevatron, but I think in terms of the Tevatron, there are now other machines in which we participate that are more at the cutting edge and are yielding more cutting edge results than we can now get from the Tevatron. We could still get some good stuff from the Tevatron and in better times we would have more funding for it, but we made, as I said, some tough choices here.

The Fermilab is a national asset. I want to see it maintained; I want to see it healthy. And—but I would simply reiterate that in this very demanding environment, we tried to make judgments about where the greatest value at the margin was for an additional dollar that could be added one place or another. And since we had to stay flat overall, dollars added one place had to be taken away in another.

Mr. HULTGREN. First, I would say Fermilab has been incredibly cooperative as far as shutting down the Tevatron and also in Hadron and CERN, all the work that is going on there. I know they have been a great partner over there. But I also absolutely believe this is a devastating departure from what we have done historically, our commitment again to discovery.

Specifically, I want to get on to LBNE, Long-Baseline Neutrino Experiment. It has been extensively reviewed, including by the National Academy and has been part of the plans for the field for the last four years. The President's budget request severely cuts LBNE and does not even provide the funds to sustain the ongoing operations at Homestake. What are the Administration's intentions with regard to LBNE and how is this momentum-killing approach an effective use of taxpayer funding or helping to drive U.S. scientific leadership?

Before you answer that, I do want to remind you of the following: that the PBR supports for the design of LBNE has been more than halved from fiscal year 2012 and Homestake mine is already operating at bare-bones efficiency and again the PBR cuts it further by 33 percent to levels insufficient to maintain minimum operations.

Dr. HOLDREN. Well, Congressman Hultgren, I have to say this is really painful. It is painful for me and painful for my colleagues to have had to engage in making these very tough choices. We are interested in keeping LBNE alive. It is, as you noticed—as you have pointed out—just limping along in this budget. I wish we could do better but to do a lot better we would have to take the money from someplace else, and our judgment was that the places we are putting it have at this point have higher potential on the margin. But I cannot tell you how much I sympathize with the view that important scientific projects in which we have invested in the past and would like to continue to invest in the future simply cannot be afforded under the current fiscal restraints. And we are constantly finding ourselves in this position where our friends in the Congress reiterate the dilemma that we already know we have, is that everybody wants to see the deficit shrunk and the overall budget smaller, and everybody at the same time wants to see the projects and programs with which they are most familiar and they know are valuable continued and expanded. And those views are simply—they can't be completely reconciled.

Mr. HULTGREN. Well, I do want to continue to work with you on this. I just have to disagree. I think there are some things that we can't afford not to do. This is something that has made America great. By us failing to do basic scientific research, we are failing our young people, we are failing our future. And again, there is huge discrepancy there when 110 million of increase goes to one program and 8 million goes to everything else. Something can be done to even that out to make sure that we are not absolutely cutting the legs out from programs that are doing good work that really are the promise for our future, future generations. So I do look forward to working with you.

With that, I yield back.

Chairman HALL. I thank the gentleman.

The Chair recognizes Ms. Fudge, the gentlelady from Ohio, five minutes.

Ms. FUDGE. Thank you, Mr. Chairman.

And thank you, Dr. Holdren, for your testimony today.

Certainly, I was pleased to see that the funding request for ARPA–E represents a $75 million increase from fiscal year 2012. For the record, would you please explain the importance of this

program and why the Administration chose to increase the funding by this amount?

Dr. HOLDREN. Well, of course, the whole point of ARPA–E is to invest in high-risk, potentially high-return research, transformational—potentially transformational research thinking outside the box. This is what the model of the Defense Advanced Research Projects Agency did with such huge success. We think ARPA–E has already shown a terrific track record in picking great ideas to support and it is our strong impression that there are more great ideas to support that have been supported up until now. And so we are trying to ramp the budget up. We didn't actually get as much as we asked for in each of the past years, but hope that Congress will agree with us this year on this sum because they are doing a great job over there. And the future of America's energy supply, the future of our capacity to reduce our dependence on foreign oil, our capacity to provide affordable and reliable energy in ways that also respect the environment and reduce the risk from climate change, we have got to be doing this outside-the-box thinking and ARPA–E is the place where we are trying to do a lot of it.

Ms. FUDGE. Thank you. I wholeheartedly agree.

Second question, Dr. Holdren, during the Science Committee's last hydraulic fracturing hearing, Dr. Goldstein from the University of Pittsburgh and a former Assistant Administrator of the Office of Research and Development at EPA explained that there are very few public health scientists engaged in research related to hydraulic fracturing, and more generally, the impacts of the current gas drilling boom. How will the initiative take public health impacts into effect and could it be helpful to include the National Institutes of Health in this new initiative?

Dr. HOLDREN. Well, certainly the new initiative plans to look at potential health effects, particularly, of course, from water contamination and how to ensure to minimize those. The Environmental Protection Agency, of course, is very much involved and has that responsibility. They routinely draw on expertise not only within the EPA but outside it, including in the NIH when they need it. And I am sure they will be doing so in this case.

Ms. FUDGE. Thank you. As you may know, NASA's fiscal year 2013 request for education is $100 million, a $36 million reduction from the appropriation for 2012. How can NASA make progress in improving the effectiveness of its education programs if the Agency is constantly reorganizing and restructuring its activities?

Dr. HOLDREN. You know, we constantly have a big challenge with NASA; it is the same challenge I was describing a moment ago, namely, budget caps and too many great and important missions inside that agency to fit within the budget. We all wish, again, that we had more for virtually every program in NASA, but when we did the comparative evaluation that I mentioned before when we looked at STEM education programs all across the government and tried to figure out where the highest gain, highest leverage for additional dollars would be, where we should increase, where we should cut, the NASA program lost a bit in that domain. And that was partly the result of the comparative assessment across the STEM ed program and partly the result of the overall

pressure in NASA to do everything and to do everything well. Those are tough balancing acts. We did the best we could. I think it makes sense but I am sure that you in Congress will be having another look at it.

Ms. FUDGE. I thank you, Mr. Chairman. I will stay in my five minutes. I yield back.

Chairman HALL. And I thank the lady.

Recognize Mr. Cravaack, the gentleman from Minnesota, for five minutes.

Mr. CRAVAACK. Thank you, Mr. Chairman.

Dr. Holdren, thank you for coming today. Dr. Holdren, when I was researching this, I came across something that was a little bit more chilling for me actually. Now, I am a member of Homeland Security Committee, as well as a 24-year Navy veteran, spent three years in the South China Sea. My experiences working in both these capacities has made me acutely aware of the threats that China poses to our national security. Thus, I am always concerned when I hear about the United States in any capacity collaborating with China on research projects, data sets, technology knowhow that could be used as dangerous strategic rival and adversary to our global influence.

It is my understanding that your office decided to engage in these sorts of collaborations with China by participating in the U.S./China strategic and economic dialogue in May of 2010 despite knowing full well that there was language signed into law by President Obama prior to your engagement in those U.S./China dialogues that clearly prohibited NASA and OSTP from using federal funds to develop, design, plan, promulgate, implement, or execute a bilateral policy program, order, or contract of any kind or participate, collaborate, or coordinate in this fashion.

It is my further understanding that the GAO investigated this issue and on October 11, 2011, issued an opinion that OSTP violated the law under the Anti-deficiency Act, which is a fiscal statute that makes it illegal for federal agencies to spend funds that have not been appropriate by Congress.

Therefore, Dr. Holdren, I have two questions for you, sir. First, does OSTP plan to continue to participate, collaborate, or coordinate bilaterally with the Chinese this year in the same manner that is found by the GAO to be in violation of the law? A simple yes or no will do, sir.

Dr. HOLDREN. To that question a simple yes or no is not practical.

Mr. CRAVAACK. Please explain.

Dr. HOLDREN. The 2011 appropriations language was deemed by the Office of Legal Counsel and the Department of Justice in a formal opinion to be inconsistent in part with the Constitutional prerogatives of the President to conduct foreign diplomacy. And I was so advised and I was advised that the opinions of the Department of Justice are binding on officials of the Executive Branch, including when GAO has a different opinion.

The FY 2012 appropriations language is different. Under the FY 2012 appropriations language, which now applies, we are allowed, both in OSTP and NASA, to engage in interactions with China provided that we supply the Congress with 14 days' notice of our in-

tention to do so and certify that we will not be transferring sensitive information either with respect to security or intellectual property in the course of those interactions. So, of course, in any interactions with China going forward, of which some are planned, the strategic and economic dialogue scheduled for May in Beijing and surrounding meetings of the Joint Commission on Science and Technology and the U.S./China dialogue on innovation policy, we have already notified the appropriate Members of Congress of our plans to participate and have certified that we will not either be transferring sensitive information or meeting with individuals who have been deemed to be directly involved in human rights violations. So we will be in our future activities within the current law. In terms of our past activities, the binding legal authorities in the Executive Branch were our guide as to what we should and should not do.

Mr. CRAVAACK. With that said, sir, GAO did find that determining the constitutionality of the legislation, the providence is in the courts and also said "in our view, the legislation that was passed by Congress and signed by the president therefore satisfies the Constitution's bicameralism presentment requirement that is entitled to heavy presumption in favor of the constitutionality of the rule." And with that said, let me go—even with the Ranking Member saying that emphasis should be for us in the United States to succeed in competitive technology, and yet, notwithstanding the obvious, the serious legal implications of your continuation to do so in my opinion, why do you feel it is in the interest of the United States of America to share technology that may have a proliferation of technology that can be used for military purposes and research with the country that directly competes with the United States and is intent on stealing information quite emphasized on American technologies and innovations? I don't understand that, sir. Could you explain it to me?

Dr. HOLDREN. Sure. First of all, I do not believe in sharing with China technology or information that could give them an advantage in the security domain or in areas in which we compete with China. Our cooperation with China is strategic. It focuses on domains in which it is in our interest for China to improve its capabilities. It is in our interest to avoid nuclear reactor accidents in China. It is in our interest to avoid the theft of nuclear materials from Chinese facilities. It is in our interest to cooperate with China on influenza so that we get more notice of influenza strains that develop in that part of the world before they get here. It is in our interest to work with China to help them reduce their emissions of pollutants that affect our wellbeing. Those are the kinds of focuses in which we engage with China in a cooperative way.

And I should add that the U.S./China Science and Technology Cooperation Agreement, under which we operate, was concluded in 1979 and has been observed and expanded by every Administration since, Republican as well as Democratic, precisely because it has been recognized on both sides of the aisle that strategically focused cooperation with China is in the national interest of the United States.

Mr. CRAVAACK. I am out of time for a very long debate and I will yield back.

Chairman HALL. I thank the gentleman for his good questions.

Ms. Lofgren, we recognize you for five minutes.

Ms. LOFGREN. Thank you, Mr. Chairman.

And thank you, Dr. Holdren, for being here and for your good work on behalf of our country's future. I wanted to learn more about the proposals in fusion energy and high energy physics generally. We have got the top line reduction, but it is hard to tell what that is going to mean on the ground. And I would just like to note that I think a better process for putting the budget together would be to actually involve the national labs at the very beginning in putting together the proposals rather than having them find out about the same time we do what the top line number is going to be.

Lawrence Livermore Lab is not in the district I represent so—but it is something that has received—the National Ignition Facility has received bipartisan support for decades. We have spent billions of dollars to get the project to where it is today. And on January 26, the announcement was made that with a very high degree of confidence, they believed that ignition will be achieved within the next 6 to 18 months. I want to make sure that the budget that we have here doesn't upend decades of work and billions of dollars that have been supported on a bipartisan basis to get where we are today when we are almost to the end of the effort. Can you enlighten us on this?

Dr. HOLDREN. Well, let me say, first of all, that the national laboratories are involved in the budget process because of their close connections with the Department of Energy. The leadership of the laboratories consult with the leadership in the Department of Energy in determining that submission.

Ms. LOFGREN. Let us go back to that later. Could you get specifically to the NIF?

Dr. HOLDREN. I can't go specifically to the NIF because I don't have in front of me that level of disaggregation of the budget. I have long and affectionate connections with Livermore having been on the staff there in the early '70s. I was a consultant to the Inertial Confinement Fusion Program for about 20 years thereafter, so I recognize how important it is, how valuable the information from that facility is, but I can't answer your question at this moment about the budget. But I will be happy to get back to you about it.

Ms. LOFGREN. Can you answer—I mean on the top level sheet, we have the—I have got to put my glasses on—the .7 and the 1.8 reduction in fusion energy and high energy physics. Do you have any idea what that reduction is going to translate to in terms of——

Dr. HOLDREN. Well, part of the reduction in fusion is that we are not going to be able to increase the U.S. contribution to the International Thermonuclear Experimental Reactor at the rate that was programmed in the ITER agreement, and we have already spoken with our partner countries about that. So there is some hit on the fusion side—the magnetic fusion side there. But I am simply not in possession off the top of my head of what the numbers are on the National Ignition Facility.

Ms. LOFGREN. Could you do this——

Dr. HOLDREN. I will get back to you.

Ms. LOFGREN. —would you get back to me?

Dr. HOLDREN. I would be happy to do that.

Ms. LOFGREN. Because I think back on when a former Member of Congress, Bill Baker, and some may remember him, I mean this has been a rare bipartisan, you know, effort to make this work and it would just be a tragedy for the country to step back at the last minute when we are almost there.

I will just shift now to the NASA budget. Given where we are in terms of the overall budget, I guess I am one who thinks that you have done a reasonably good job in trying to put something together that will work, and I want to compliment you for that. In terms of the international effort, you know, I remember being on the Committee in the '90s and the arguments we had on the International Space Station, and I will say in terms of the money and the collaboration, it didn't work out the way it was planned. It became really more of a foreign policy effort for U.S./Russia relations than it did for anything else.

So I guess, you know, on a global level, when I look at what is happening in the economy and the EU, I have a high degree of skepticism about not just our involvement but ultimately their involvement. And so I think the proposal being made by the Administration is a prudent one and I think the overall NASA budget is a pretty solid one. I wanted to compliment you for that.

And Mr. Chairman, I yield back.

Chairman HALL. I thank the lady for yielding back.

Recognize Mr. Smith, the gentleman from Texas, for five minutes.

Mr. SMITH. Thank you, Mr. Chairman.

Dr. Holdren, thank you for your service. Thank you for your expertise.

I would like to first follow up on a couple of questions that you have already been asked. The Chairman, Mr. Hall, asked you a few minutes ago about the Administration's commitment to going to Mars. You answered affirmatively. I wonder if that commitment means that you feel that there will be no more delays in the development of the SLS? As you know, there was a six month delay last year. Do you foresee us staying on schedule with the development of the SLS?

Dr. HOLDREN. Congressman Smith, I have cloudy crystal ball when it comes to predicting whether or not further delays will be encountered, particularly in projects as complicated as rocket science. I did some rocket science early in my career and I know there are many pitfalls. So I cannot guarantee you that there will not be further hurdles that have to be overcome, but our expectation is to keep SLS on schedule. We want to have that capability.

Mr. SMITH. You——

Dr. HOLDREN. We share that with the Congress.

Mr. SMITH. You were not aware of any plans to delay it? Okay, thank you.

To follow up on another question you were asked about fracking and no doubt you haven't seen the report yesterday, but yesterday, at the meeting of the American Association for the Advancement of Science in Vancouver, there was an important report that was released showing that many of the concerns expressed about

fracking could be addressed, and I just hope you will take some time to look at that report and that might help you get beyond sort of the cautious approach to fracking in the future.

Dr. HOLDREN. Look, it is also my view that the concerns can be addressed. I want to make sure that we do address them——

Mr. SMITH. Right.

Dr. HOLDREN. —so that we are able——

Mr. SMITH. Right.

Dr. HOLDREN. —to benefit from that very important resource.

Mr. SMITH. The report was given by a former head of the Geological Survey, so he has some credibility on the subject.

Another question is this: the Environmental Protection Agency claims I think 12 or $13 billion in savings from their proposed mercury standards on utilities. Members of Congress have not been able to get our hands on the data or analysis that they relied upon after many months of effort. Can you get us that information as well as let us know who paid for the analysis?

Dr. HOLDREN. I believe I can and I will certainly look into that as soon as I leave this hearing.

Mr. SMITH. Okay. And when would you be able to get us that information do you think? Within a week?

Dr. HOLDREN. Again, my crystal ball is cloudy but I don't see any reason that we cannot get that information for you, and so I will start working on it immediately.

Mr. SMITH. Thank you, Dr. Holdren.

Thank you, Mr. Chairman. I yield back.

Chairman HALL. The gentleman yields back.

Recognize Mr. Tonko, the gentleman from New York, for five minutes.

Mr. TONKO. Thank you, Mr. Chair.

Dr. Holdren, as an energy expert, I believe you would agree with me that the cheapest energy we are ever likely to get is through improvements in efficiency. We have made some progress in that area but I believe there is much more that we can do. Would you talk about the initiatives in the budget to improve efficiency in production, storage, and use of our energy supplies?

Dr. HOLDREN. Wow, that is a wonderful question. I was one of those who was saying actually in the 1970s that increasing energy efficiency is the cheapest, safest, fastest, cleanest, surest way to enhance our energy system and our energy prospects. And the renewable and efficiency division in the Department of Energy is proposed for very substantial increases in this budget exactly for that reason. If you look at the focuses of the energy hubs, which are one of the centerpieces of Secretary Chu's innovation strategy in energy, there is a hub on improving battery and energy storage technology; there is a hub on building energy efficiency; and the sixth hub, which is now being proposed, is a hub focusing on the grid and the efficiencies that can be derived there. So we have a big emphasis on increasing efficiency precisely because of the leverage that you point to in that domain. It passes our test of where additional dollars do the most good.

Mr. TONKO. Thank you. The President has also focused on strengthening our manufacturing sector, and by strengthening it, I believe we need to address again the sort of innovation and effi-

ciency that is possible within manufacturing. There are those who believe in that investment; others would suggest that we are picking winners and losers and it becomes interventionist in design and unacceptable. Can you address areas where government sponsorship in your opinion of research could fill gaps that the private sector alone cannot?

Dr. HOLDREN. Well, Congressman, I would answer that in two ways. First of all, we know that the private sector tends to underinvest in basic research for the very simple reason that the results are unpredictable, the rate of return cannot realistically be estimated, and many of the benefits are not appropriable by the investor. That is, the results of basic research propagate in ways that many different people benefit rather than just the folks who paid the bills. For that reason, it has always been the case that the government has had to be a leader in investment in basic research, and yet the flow of discovery that comes from basic research feeds the innovation that produces the next generation of products, process improvements, new techniques for manufacturing that ultimately benefit the economy.

The second thing I would say is as opposed to picking winners, what the government is doing in the way of encouraging innovation beyond its strong investments in basic research, which is its historic responsibility in this domain, are cross-cutting systematic ways to encourage innovation in the private sector. So again we talk about simplifying and making permanent the research and experimentation tax credit. We talk about unlocking access to capital, including a $2 billion fund being proposed to match private funds investing in underserved markets and early-stage companies. In the Startup America Initiative we have a program for connecting mentors to entrepreneurs. So we take successful entrepreneurs who mentor emerging ones on what it takes to succeed to improve the success rate in entrepreneurship.

We have been building up a variety of ways, as I mentioned before, to connect our research universities and their laboratories and the national laboratories to the private sector in a manner that will accelerate the flow of discovery into practical innovations in the private sector without respect to picking particular products or potential products or particular processes but strengthening the innovation ecosystem that produces these flows.

Mr. TONKO. Thank you very much.

Mr. Chair, I yield back.

Chairman HALL. The Chair now recognizes the gentlelady from Illinois, Ms. Biggert.

Mrs. BIGGERT. Thank you, Mr. Chairman. And thank you for being here, Dr. Holdren.

In your testimony you referred to the DOE Office of Science as a jewel-in-the-crown agency that is especially important to this Nation's continued economic leadership. And you also note that the President remains committed to doubling the budget of key basic research programs at the Office of Science along with NIST and NSF. However, the budget request for the Office of Science is proposed to increase by only 2.4 percent. At that rate, it would take about 30 years to double the budget and that doesn't even account for inflation and what would occur during that time.

And meanwhile, we have got some unproven maybe green energy programs within DOE such as EERE and ARPA–E, proposed to increase by 29 percent and 27 percent respectively. Why is the funding for the Office of Science such a low priority relative to other DOE programs?

Dr. HOLDREN. Well, first of all, we are committed, we remain committed to keeping the NSF, the DOE Office of Science, and the NIST laboratories on a rising trajectory. Clearly, the budget constraints under which we now operate have made the goal of doubling more difficult, and unfortunately, your arithmetic is correct. At that growth rate in the Office of Science it would take a long time for it to double. And we have made tough choices across NSF, DOE Office of Science, and NIST laboratories trying to look for the most promising opportunities to increase things.

When you mention the unproven technologies in DOE that are getting attention, of course, it is precisely the unproven technologies that require government attention. The proven technologies will be pursued successfully by the private sector. And we think there is a large societal interest in getting some of the unproven technologies into the proven category because they will bring big benefits in reduced oil dependence, reduced import dependence, improved environmental characteristics, and so on.

Mrs. BIGGERT. What does worry me is that we have had, you know, the green energy—we could call it boondoggles I guess such as Solyndra, and that might signal that the DOE should make the well managed world class basic research at DOE a higher priority.

But my next question is about a different subject and that is the—our Nation's communication system is repeatedly threatened by cyber attacks making the protection of critical infrastructure a national priority. How does the Administration propose to use our supercomputing resources to spur new research that keeps us ahead of ever-innovating attackers?

Dr. HOLDREN. I would love to be able to answer that question, but of course a lot of what we are doing in that domain is understandably classified. But you can be sure that cybersecurity is a very high priority for this Administration. We understand the threat. We have a cybersecurity strategy. We are employing all manner of scientific and technical resources to try to stay on top of this threat, which is real and is large.

Mrs. BIGGERT. Can you say anything about how the research can be connected to industries and agencies that need to protect their systems?

Dr. HOLDREN. Absolutely I can. Within the President's Council of Advisors on Science and Technology, which is set up to provide the Administration reach into the private sector, the academic sector, the philanthropic sector, we have the former CEO of Google, the Chief Technology Officer of Microsoft, and so on and so forth as members of PCAST. We have a PCAST working group on cybersecurity that is focused on exactly this question, but we also have within the government a variety of committees—the National Science and Technology Advisory Committee, NSTAC, which is composed of the leaders of the information industry—who come together in Washington and advise the Administration, Department of Homeland Security, the National Security Agency, Central Intel-

ligence, the White House on how we can coordinate our efforts in cybersecurity. So this is a big focus.

Mrs. BIGGERT. Thank you. Thank you very much.

I yield back.

Chairman HALL. The Chair now recognizes the gentleman from New Mexico, Mr. Lujan, for five minutes.

Mr. LUJAN. Mr. Chairman, thank you very much as well.

And Dr. Holdren, thank you so much for being here with us. We appreciate the commitment to research and development and innovation as keys to America's economic success.

And Mr. Holdren, I want to jump right into the area that—I appreciate the questions that have come from our colleagues, the attention to the national labs from both sides of the aisle with Mrs. Biggert, Ms. Lofgren, as well as Mr. McNerney, and the explanation to Mr. Tonko with the innovation ecosystem. I think inherently therein lies the answers to many of America's economic woes when we talk about innovation as well as economic strength are America's national labs. Coming from a state that has both Sandia and Los Alamos National Laboratory, we understand the importance of that science and the research that takes place there.

We would ask Mr. Holdren—or Dr. Holdren, now that you have had the ear of the President—and with Dr. Chu—that when we are talking about the Entrepreneurial Leave programs that many of our scientists, physicists, engineers, mathematicians, and experts at our national labs can engage in as well addressing the conflict of interest inherently associated with making them more available to small businesses, entrepreneurs out there—that we address that and look closely at that to see what can be done because there is good work that is being done and it looks good on paper, but all indications is there is dramatic room for improvement. And I really believe that once we unleash the power inherently therein from our national labs, we can solve those economic problems and not just stop there. There is promise across the country with physicists, scientists, and engineers at many of our national labs working with teachers and students and improving our educational system across America.

And just in the way we would talk about an Entrepreneurial Leave program, I think we can talk about an educational leave program associated with many of those bright minds that we have within our national labs to help solve those problems. And I would suggest that it is part of our national security to be able to address many of these issues.

Specifically, Dr. Holdren, a few months ago the President issued an executive memorandum urging the federal agency heads to step up their technology transfer activities. Could you please address the progress being made in this area and if any of this is reflected in the 2013 budget? And also the *Energy Policy Act of 2005*, a technology commercialization fund was created within the Department of Energy to promote promising energy technologies for commercial purposes, and I would like for you to share a little bit about that as well.

Dr. HOLDREN. Okay. Big questions for a short time period. But let me say, first of all, I agree with everything you said about the importance of the national labs and the fact that there is more we

could still do to facilitate making those intellectual resources more widely available. The President's Educate to Innovate Program, which he announced originally in November of 2009, has as one of its major features bringing practicing scientists, engineers, and mathematicians from national labs, research universities, and firms into classrooms, middle school, high school classrooms to work with science and math teachers to provide more hands-on activities and experiences that get kids excited about science and engineering and to serve as role models. I have already mentioned the innovation hubs that again are aimed at making sure the expertise in the national laboratories get applied in the private sector and in the marketplace.

You mentioned the executive order on accelerating technology transfer activities and asked for a progress report. As far as I know, it is too soon to have any quantitative measures of how well that is working, but I will try to get back to you on it, see if we have anything on that already. But my guess is it is a little soon to judge the degree of success these programs are having. But I can certainly assure you that both in my office and in the West Wing of the White House there is a tremendous amount of interest in getting this right. The Jobs Council, which has met regularly with the President, is focused on this. OSTP is focused on it. I think the room for improvement is going to be exploited and we are going to improve.

Mr. LUJAN. Thank you for that, Dr. Holdren. And the only thing I would add, in addition to thanking you and the team that is with you today as well as those that are probably tuning in, is as we talk about the contracts with the national labs, as those are coming up, that to the extent possible that we tie job creation as well as the technology commercialization, maturation, and transfer aspects associated inherently with those contracts so that way we can encourage that behavior as much as we possibly can.

And I appreciate your attention to this in support of the national labs as well, sir.

And with that, Mr. Chairman, I yield back.

Chairman HALL. And I thank you for yielding.

Now, the very patient Mr. Sarbanes is recognized for a quick five minutes.

Mr. SARBANES. Thank you very much, Mr. Chairman. I appreciate that.

Thank you for your testimony today. There is a program under NIST called the Manufacturing Extension Partnership, which I know you are familiar with and it is a resource to manufacturers across the country to help sort of boost their opportunities and organize those opportunities, et cetera. And there is an initiative within the MEP program called the Supplier Scouting Program, which is—I don't think it occupies a major line item in the budget, but it is a recent initiative that attempts to match small- and medium-size American manufacturers with these various supply chain needs that arise as a result of major infrastructure projects across the country. So it is a terrific idea and innovation because what it is doing is it is really helping make that connection so that when you have a major infrastructure project, you can get bidders and

vendors coming forward who are American manufacturers and they can get into that supply chain.

And I really just wanted to commend NIST for this and the innovation that the MEP program has managed to put forward here with the Supplier Scouting Program. There has been a lot of progress with this with—the Department of Transportation, has taken a lot of initiative, the Department of Energy, the Defense Department, and I think it is a terrific model going forward for how you make these connections and just hope that, you know, the President will continue and you will continue to support that kind of initiative, particularly now as we are recognizing the real opportunities to boost American manufacturing going forward. This is something that we can take full advantage of and I just hope that that will continue to be a point of emphasis with you.

Dr. HOLDREN. Well, it is going to be a continuing point of emphasis. It gives me an opportunity to say that NIST is an amazingly agile and effective organization. Its head, Dr. Pat Gallagher, is one of my closest colleagues and collaborators in this domain of innovation in figuring out how to lift our game in promoting manufacturing and particularly high-tech advanced manufacturing in this country. The Advanced Manufacturing Partnership, which has been headed by Andrew Liveris of Dow; and Susan Hockfield, the President of MIT has been part of that linking industry, academia, and the government in some of these initiatives. And so I thank you for that comment. This is a high priority for us and we are going to keep pursuing it.

Mr. SARBANES. Thank you. Let me ask you another question. There is something called the National Science and Technology Council Committee on STEM Education, which recently, as you know, submitted its first annual report and apparently identified about 252 federally funded STEM activities across the government that are currently underway and noted that in many instances they have different objectives, they are focused on different products, they have different target audiences, et cetera, and recommended that there be a more efficient approach to this looking for better coherence among these multiple programs. And I wanted to get your comment on that. I think you were involved in some of those findings and I am also curious as to whether you think the efficiency we like to see there in terms of the way these programs work together and these initiatives work together is something we can rely on the agencies to undertake themselves or whether they could use a push from the President and his office to make that happen.

Dr. HOLDREN. Well, thank you. Yes, the National Science and Technology Council is a body that was created in order to make sure that all science- and technology-related activities across departmental and agency boundaries are appropriately coordinated. And I chair it on behalf of the President and all the agencies that have science and technology and STEM education missions are represented there.

And so it has five standing committees under the Council, and one of those is the STEM Education Committee that is chaired by Dr. Carl Wieman, the physics Nobel Prize winner who is my Associate Director for Science in OSTP. And as you point out, they did

do a survey which established that there are well over 200 programs in STEM education spread across the agencies, but the idea was not that these all need to be consolidated. The idea was to determine to what extent there is overlap and duplication in their activities and their missions and to try to determine which ones are more effective and which ones are less effective.

But we recognize and the NSTC STEM Education Committee recognizes that a lot of the diversity in those programs is fully warranted. These agencies and their programs have different focuses, different missions, different constituencies, different sets of kids and different levels of education on which they are focused. And our intention in following up those recommendations—and I mentioned there is going to be a strategic plan forthcoming shortly—is not to pretend that one size fits all in STEM education and scrunch these things altogether, but rather to coordinate and orchestrate the appropriate diversity of these programs in a way so that to the extent that there is duplication and to the extent that there are important missions that are left out altogether, we fix that.

Mr. SARBANES. I appreciate it. I yield back, Mr. Chairman.

Chairman HALL. Thank you, Mr. Sarbanes.

And Dr. Holdren, I thank you and we all thank you for your very valuable testimony and for the time you have given us. And I thank the Members for their questions.

I might ask that the Members of the Committee have additional questions to you, Dr. Holdren, that they will submit to you, ask that you respond to them in writing when you can, as soon as you can. The record will remain open for at least two weeks for additional comments from Members.

And with that, Dr. Holdren, you are excused and the hearing is adjourned.

[Whereupon, at 11:15 a.m., the Committee was adjourned.]

Appendix

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by The Honorable John P. Holdren,
Director, Office of Science and Technology Policy

OSTP responses House SST QFRs 4/19/12

Questions for the Record
The Honorable Ralph M. Hall, Chairman

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

An Overview of the Administration's Federal Research and Development Budget for Fiscal Year 2013

Friday, February 17, 2012
9:30 a.m.

QUESTIONS FOR DR. HOLDREN:

1. The Keystone XL Pipeline would deliver an estimated 830,000 barrels of oil per day to U.S. refineries, greatly alleviating pressures that contribute to current high gas prices. Unfortunately, the President rejected the pipeline in January, citing environmental concerns. Specifically, the President's statement rejecting construction of the pipeline said that "Congressional Republicans prevented a full assessment of the pipeline's impact, especially the health and safety of the American people, as well as our environment." This objection appears to be centered on the technical question of whether the pipeline can be built safely. To this end, please describe your office's involvement in sharing input and advice related to the President's decision to reject construction of the Keystone XL Pipeline. Please also detail why the President believes the multi-agency regulatory review of the pipeline (now in its third year) that produced among other things an independent and detailed Environmental Impact Statement (EIS) of the pipeline is not sufficient to inform his decision on this issue. Please also provide your current assessment of the pipeline's impact on the health and safety of the American people, as well as the environment. Are you aware of the potential environmental or technical issues associated with the pipeline that cannot be addressed?

Answer:

OSTP played no role in the President's decision on the Keystone XL pipeline and did not conduct an assessment of the impact of the pipeline on health, safety, or the environment. I would refer you to the State Department for any questions that you may have regarding the impacts of the Keystone XL pipeline.

2. With respect to the President's proposal that funding for his Council of Advisors on Science and Technology (PCAST) be paid for through appropriations to the Department of Energy (DOE) Office of Science, please provide the reasoning and justification for this proposal and a summary of anticipated costs, categorized by subject area (personnel, travel, etc.).

Answer:

Substantial reductions in OSTP appropriations for FY 2012 necessitated the movement of administrative support costs for PCAST to the Department of Energy's Office of Science, one of the Federal agencies that benefit from PCAST recommendations and that has well-developed administrative practices for Federal advisory committees. Annual costs for PCAST are approximately $200K for personnel, $300K for travel, and $300K for administrative support, venue rental, audio/visuals, webcasting, and other logistics. The OSTP Director remains the co-chair of the council and OSTP remains responsible for setting priorities, providing policy oversight, and delivering PCAST recommendations to the President.

3. A recently released Congressional Research Service (CRS) report entitled "The President's Office of Science and Technology Policy (OSTP): Issues for Congress" states that of OSTP's current staff of 92 employees, 65 are supported as either detailees (49), fellows (6), Intergovernmental Personnel Agreements (IPAs, 9), or consultants (1). Please provide a summary of the funding sources associated with these 65 employees, including the entities that provide support (i.e. agencies and sub-agencies as appropriate) and the aggregate costs (by agency/sub-agency or entity) of those supported.

Answer:

In accordance with our organic statute, OSTP greatly relies on the scientific and technical expertise of experts from across the Executive Branch, the National Laboratories, and other organizations as appropriate. High-level expertise is required to address the Nation's most difficult challenges in areas such as science, technology, engineering, and math ("STEM") education, advanced manufacturing, human health, energy, space exploration, nuclear physics, national security, and many other areas. These arrangements provide the flexibility needed to address both on-going and emerging technical and scientific challenges while ensuring that OSTP retains only the most qualified experts.

Federal detailees

Agency	# of detailees	Approximate annual cost*
Army	3	$400K
CIA	1	130K
DARPA	1	150K
DOC	1	150K
DOE	8	1200K
DOJ	1	110K
EPA	2	280K
FAA	1	180K
FCC	1	150K
NASA	3	450K

Navy	**1**	**130K**
NIH	**1**	**130K**
NIST	**3**	**450K**
NOAA	**4**	**600K**
NSF	**10**	**1500K**
NTIA	**2**	**300K**
State	**2**	**250K**
USCG	**1**	**150K**
USGS	**2**	**300K**
VA	**1**	**150K**

Intergovernmental Personnel Act agreements

Organization (1 each)	**Approximate cost***
George Mason University	**140K**
Carnegie Mellon University	**210K**
New York Law School	**120K**
Gordon and Betty Moore Foundation	**220K**
Morgridge Research Foundation	**130K**
Los Alamos National Laboratory	**230K**
Lawrence Berkeley National Laboratory	**130K**
Lawrence Livermore National Laboratory	**180K**
Sandia National Laboratory	**212K**

Fellows

American Association for the Advancement of Science (3)	**280K**
American Society of Mechanical Engineers Foundation	**60K**
Congressional Hispanic Caucus	**30K**
New York Law School	**80K**

OSTP's single consultant is a full-time employee paid directly by OSTP. The annual cost – salary plus benefits -- is approximately $180K.

*** - All costs are estimated and include benefits where relevant.**

4. What is the status of scientific integrity policies at government agencies and departments? (Agencies were supposed to submit these policies to OSTP by December 17, 2011). Have all agencies complied? Please identify those that have not and the reasons for non-compliance.

Answer:

All departments and agencies with science or engineering as a core component of their missions are in compliance with the scientific integrity directives that I have

posted to date. These include an initial directive, posted on December 17, 2010, asking that such departments and agencies provide, within 120 days after that date, reports describing their progress toward the development of individualized scientific integrity policies that meet the minimum standards described in my December 2010 Memorandum, as well as subsequent deadlines set by me to ensure continuing progress towards that goal of promulgating final policies. At this time, all 22 departments and agencies—covering the complete spectrum of science- and engineering-centric Federal entities—have either completed their final policies or have completed penultimate drafts that are in final review. Policies that have been made public (either in final form or in draft form for public review) can be seen at: http://www.whitehouse.gov/administration/eop/ostp/library/scientificintegrity.

5. As recognized by the DOE and industry, a critical factor in the availability of rare earth elements is recycling and reuse. What are OSTP's budgetary initiatives to advance research and development of recycling and reuse technologies?

Answer:

The OSTP-convened interagency process has established three core objectives: (1) diversify the supply of critical minerals; (2) mitigate long-term risks associated with a dependence on critical materials with consideration for the full supply chain; and (3) inform government and industry decision making. Recycling, reuse, and more efficient use could significantly lower worldwide demand for newly extracted materials and is an important part of a long-term risk-mitigation strategy. Research into recycling processes coupled with well-designed policies could help make recycling economically attractive. DOE is pursuing R&D that addresses materials separation and processing and reducing material intensity, and developing substitute materials and approaches in energy technologies. In the FY2012 appropriations, DOE received $20 million for an Energy Innovation Hub on Critical Materials. The President's FY2013 budget request sustains funding for this Hub. Both the DOE and EPA have announced Small Business Innovation Research (SBIR) grants that address processing of critical materials. DOE also has an R&D program aimed at early-stage technology alternatives that reduce or eliminate the dependence on rare earth materials.

6. What is OSTP's role in promoting a private/public collaboration in the development of technical standards, guides and best practices for recycling technologies on rare earth minerals?

Answer:

In coordination with the OSTP-led interagency process, EPA and its stakeholders are exploring how standards might encourage recycling of rare earth materials at the end of some products' lives, and use of these recycled materials in new products.

The standard they are exploring is under the IEEE 1680.1 standard for the Environmental Assessment of Personal Computer Products, which is about to be updated. Products meeting this standard are called EPEAT registered, and the Federal government is required to buy EPEAT-registered products by Executive Order 13514 and the Federal Acquisition Regulations (FAR).

7. According to the White House's Transatlantic Economic Council Joint Statement of November 29, 2011, "the United States and the EU will collaborate to advance the work of the OECD Working Party on Resource Productivity and Waste, particularly its work on sustainable minerals management (SMM)". What role is OSTP playing in this OECD effort to promote and increase materials recovery, resource efficiency and greater realization of resource productivity? How is U.S. industry being engaged in this effort?

Answer:

OSTP has been an active participant in the Transatlantic Economic Council (TEC) discussions and will continue to engage in multilateral discussions with our international partners on this and other topics related to raw materials.

To advance our understanding, U.S. industry has been actively engaged in the OSTP-led interagency process through the activities of the Department of Energy (DOE), the Department of Commerce (DOC), and the Office of the U.S. Trade Representative (USTR). For example, OSTP has created several working groups as part of the broader interagency effort. One working group is tasked with identifying critical resources that could contribute to future national economic prosperity and strategic security. That group, led by DOC, hosted an industry roundtable on March 23.

8. Bisphenol-A (BPA) is used to make many food-contact and medical products that are regulated by the Food & Drug Administration (FDA). Given the FDA's current "in-depth studies to answer key questions and clarify uncertainties about the risks of BPA," what is the purpose and the federal government's interest in studies being funded by the National Institute for Environmental Health Sciences (NIEHS)? Is there redundancy and overlap that might exist with NIEHS funding?

Answer:

The FDA and the National Institutes of Health's NIEHS collaborate, along with the Centers for Disease Control and Prevention (CDC), also a unit of the Department of Health and Human Services (HHS), on the National Toxicology Program (NTP). The NTP reports to the HHS Assistant Secretary for Health. Its mission is "to evaluate agents of public health concern by developing and applying tools of

modern toxicology and molecular biology," as expressed in its mission statement. To fulfill its mission, NTP coordinates the research efforts of FDA, CDC, and NIEHS on topics including Bisphenol-A (BPA) and has the power to conduct independent scientific peer review of studies. The NTP, assisted by its three external advisory groups (one of which includes representatives from Federal departments and agencies outside HHS), is a well-functioning effort to coordinate Federal toxicology programs and to minimize overlap in Federal research. FDA, of course, is a regulatory agency with strong applied research capabilities, especially in FDA laboratories. NIEHS, part of NIH, has longstanding strengths in engaging with the academic research community on basic and applied research on the environmental health sciences and has a strong basic intramural research capability. Together, these complementary research efforts inform the Federal government's response to the potential human health impacts of chemical agents.

9. According to NIEHS in 2009, the National Toxicology Program (NTP) concluded that a significant portion of the BPA literature available was not able to be fully considered in NTP's scientific evaluation of BPA due to a variety of experimental limitations. Many of the studies that were of little value for NTP's evaluation had been funded by NIEHS grants awarded before 2009. What steps has NIEHS taken to ensure that current and future research that uses federal funds will be useful to federal agencies such as NTP and FDA?
   - What is the status of these various research projects funded through NIEHS?
   - What impact do you see this research having on consumer safety and public policy moving forward?

Answer:

I would refer you to the National Institutes of Health (NIH) and NIH's NIEHS for any questions that you may have regarding specific NIEHS research grants and the use of NIEHS-supported research within HHS' National Toxicology Program.

10. For each of the Fiscal Years 2009-2013, please provide actual, estimated and requested funding as appropriate for each USGCRP centrally-funded entity/activity, as well as the amounts assessed each department/agency participating in the U.S. Global Change Research Program (USGCRP) using the following table as a template.

Answer: **(inserted into the template, in current dollars)**

OSTP responses House SST QFRs 4/19/12

USGCRP Centrally-Funded Entity/Activity	**FY 2009 Enacted (Approved)**	**FY 2010 Enacted (Approved)**	**FY 2011 Enacted (Approved)**	**FY 2012 Enacted (Approved)**	**FY 2013 Budget (Approved)**
USGCRP (NCO)	**2,107,996**	**2,017,295**	**2,130,329**	**3,595,108**	**3,559,530**
National Research Council	**800,000**	**360,000**	**365,000**	**500,000**	**400,000**
International Programs	**1,400,000**	**1,400,000**	**1,400,000**	**1,400,000**	**1,400,000**
IGBP	450,000	450,000	450,000	483,000	483,000
IHDP	120,000	120,000	120,000	63,000	63,000
WCRP	118,000	118,000	118,000	159,000	159,000
DIVERSITAS	100,000	143,000	144,000	84,000	84,000
ESSP	43,000	0	0	0	0
START	569,000	569,000	569,000	611,000	611,000
Other? (Please specify)	0	0	0	0	0
IPCC	**482,106**	**1,646,221**	**2,139,779**	**1,995,642**	**2,475,289**
IPCC WGII TSU	268,091	1,317,953	1,526,548	1,528,443	1,594,786
Travel for US Scientists	214,015	328,268	613,231	467,199	880,503
Etc.					
Other: NSF Administrative Costs	**175,898**	**216,000**	**243,627**	**420,494**	**431,000**
Total, USGCRP	**4,966,000**	**5,639,516**	**6,278,735**	**7,911,244**	**8,265,819**
USGCRP Participating Department/Agency Assessments					
	FY 2009	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**
DOC	731,600	913,700	1,309,800	1,650,000	1,221,900
DOD	0	0	0	0	0
DOE	393,700	439,700	596,300	751,300	808,200
DOI	80,600	116,800	159,700	201,200	226,000
DOS	0	0	0	0	0
DOT	3,100	3,400	7,100	9,000	3,800
EPA	49,600	68,700	63,900	80,500	72,800
HHS	155,000	161,400	14,200	17,900	15,300
NASA	2,675,200	2,940,200	3,066,700	3,863,900	4,186,500
NSF	635,500	704,100	780,900	983,900	1,275,500
SI	18,600	20,600	21,300	26,800	30,600
USAID	43,400	48,100	60,300	76,000	107,300
USDA	179,800	223,300	198,800	250,500	317,900
Total, Assessments (rounded)	**4,966,100**	**5,640,000**	**6,279,000**	**7,911,000**	**8,265,800**

OSTP responses House SST QFRs 4/19/12

11. Please provide the funding for the U.S. Government contribution to the IPCC Trust Fund for each of FY 2009-FY 2012, and the estimate for FY 2013.

Answer:

Department of State's contributions the IPCC Trust Fund			
	FY2009	**FY2010**	**FY2011**
Core Budget	1,500,000	1,982,425	2,332,845
GCOS (*)	200,000	350,000	350,000
Subtotal	1,700,000	2,332,425	2,682,845

(*)The Department of State's contributions to Global Climate Observing System (GCOS), a separate organization that is also a sub-body of the World Meteorological Organization, have been made through IPCC for the sake of efficiency but are not part of State Department's contribution to the IPCC's core budget.

FY12: The Department of State has not determined its final allocation for IPCC/GCOS out of the $10 million FY12 appropriation for UNFCCC, IPCC, and related bodies, but expectation is that the FY12 allocation will closely approximate the amounts shown for FY11.

FY13: The division of funding for IPCC/GCOS and other agencies within the FY13 budget request for UNFCCC, IPCC and related bodies has not yet been determined.

Questions for the Record
The Honorable Randy Neugebauer

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

An Overview of the Administration's Federal Research and Development Budget for Fiscal Year 2013

Friday, February 17, 2012
9:30 a.m.

QUESTIONS FOR DR. HOLDREN:

President Obama and some Congressional Democrats have lately been focusing energy policy on mandating a federal Renewable Portfolio Standard (RPS). However, the Manhattan Institute recently released a report on RPS that found that seven states with such a mandate saw their electricity rates increase by 54.2 percent between 2001 and 2010, which was more than double the increase in other coal-dependent states without an RPS. It goes on to say, "Put another way, the higher cost of electricity is essentially a de facto carbon-reduction tax, one that is putting a strain on a struggling economy and is falling most heavily, in the way that regressive taxes do, on the least well-off among residential users."

1. Do you agree that a federal RPS would increase the cost of electricity for Americans and have the most burdensome effects on the poorest among us? Do you believe that we should be pursuing policies that will result in Americans paying more for energy while families are simultaneously doing everything they can to tighten their belts under already difficult economic circumstances?

The President has not "focused energy policy on mandating a federal Renewable Portfolio Standard (RPS)." Instead, the President has proposed a Clean Energy Standard (CES) to keep our energy supply clean, affordable, and secure. A CES is a flexible, market-based approach with annual targets for electricity from diverse, domestic sources, including renewable energy as well as nuclear power, efficient natural gas, and clean coal. The policy would enable businesses and entrepreneurs to determine the best way to achieve the targets, ensuring that clean energy is produced wherever it makes the most economic sense. By establishing a market for domestic clean energy technologies, this policy would move billions of dollars of capital off of the sidelines and into investments that drive innovation and create jobs. The Administration is confident that a well-designed CES would promote innovation and investment in the clean energy economy while ensuring that all consumers throughout the country, regardless of income, continue to enjoy access to affordable, reliable electricity.

With respect to a renewable portfolio standard, the Energy Information Administration (EIA) has, over the past few years, analyzed several legislative

proposals for such policies. Through these analyses, EIA has found that numerous policy details can significantly influence the impact of the policy on key indicators such as the price of electricity, generation mix, cost to consumers, cost to industry, and even achievement of the targeted generation share. These key parameters include the existence and level of any limits on the price of renewable energy credits; exemptions for certain classes of utilities or exclusion of certain generation from requirements of the program; the ability to "bank" early compliance credits; and the existence of "credit multipliers," "set-aside" targets, and tiered compliance systems that incentivize specific technologies within the suite of eligible technologies. Because of the importance of policy design, it is impossible to characterize the impacts of a federal RPS policy in the abstract.

The cited Manhattan Institute study shows results that are significantly at odds with prior studies on price impacts of State RPS policies. This study suffers from numerous methodological weaknesses, including but not limited to a failure to properly account for factors other than RPS policy that may affect differences in electricity prices among States and over time. In addition, it appears to attribute to RPS policy changes in price that occurred in certain states prior to the existence of any RPS policy and/or any significant RPS targets; failing to identify any plausible mechanism by which an RPS policy could affect prices prior to its introduction into law or prior to any significant generation requirements above baseline renewable generation levels.

2. The President's budget proposes increasing the tax credit for purchasing electric vehicles to $10,000 from $7,500. Seeing as though the subsidy clearly did not succeed this past year – sales of the Chevrolet Volt were 33 percent below the target – would it be wiser stewardship of taxpayer dollars to end this failed subsidy altogether? Do you believe that these subsidies (which only target wealthier Americans who can afford $40,000 Volts and $57,000 Teslas) send distorted market signals and create disincentives for the manufacturers to innovate and make their products viable on the marketplace?

Answer:

The President's FY 2013 Budget proposes to improve the current tax credit for electric vehicles by expanding eligibility for the credit to a broader range of advanced vehicle technologies, as well as by increasing the amount from $7,500, making it scalable up to $10,000; reforming the credit to make it available to consumers at the point-of-sale; and ramping down and eventually eliminating the credit at the end of the decade. Making the credit available to a wider range of technologies and allowing for a scalable credit up to a maximum of $10,000 will help increase production of advanced vehicles that diversify our fuel use and bring down the cost of producing such vehicles, supporting the goal of reducing dependence on oil and leading to a reduction in oil consumption. Advanced vehicles offer the opportunity to transform America's transportation sector to reduce our dependence on oil, to help protect consumers from high gas prices, and to promote U.S. leadership in manufacturing efficient vehicles. Electric vehicles can offer consumers

significant advantages over gasoline-powered vehicles, including savings on fuel costs and added convenience. American automakers and automotive suppliers are currently pioneering the way forward in getting the first wave of electric vehicles into the hands of a significant number of U.S. drivers. At the same time, we recognize that the prices of these cars are still out of reach for the majority of American families. To address this challenge, the Administration has proposed a set of new initiatives to support advanced vehicles, including: improving the tax credit for advanced vehicles; accelerating the deployment of alternative-fuel commercial trucks through a new tax incentive; launching the National Community Deployment Challenge for communities to encourage advanced vehicle adoption; and announcing the EV Everywhere clean energy grand challenge. EV Everywhere is a DOE initiative that aims to make electric vehicles affordable to the average American family within a decade by targeting dramatic technological and cost improvements in batteries, electric motors, power electronics, light-weight structures, and battery-charging technology.

Questions for the Record
The Honorable Mo Brooks

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

An Overview of the Administration's Federal Research and Development Budget for Fiscal Year 2013

Friday, February 17, 2012
9:30 a.m.

QUESTIONS FOR DR. HOLDREN:

1. In your testimony, you acknowledge that the President's 2013 Budget Request expands NSF's efforts in clean-energy research, advanced manufacturing, wireless communications, cyber infrastructure, and other emerging technologies. NSF proposes to increase research funding to promote discoveries that can spark innovations for tomorrow's clean-energy technologies with a cross-disciplinary approach to sustainability science. The Science, Engineering, and Education for Sustainability (SEES) portfolio will increase to $203 million in the 2013 budget request for integrated activities involving renewable energy technologies, green chemistry, and complex environmental and climate processes.

I am sure you are aware that the American Recovery and Reinvestment Act of 2009 (ARRA) awarded the Department of Energy's Office of Energy Efficiency (EERE) $16.8 billion for its programs and initiatives, approximately ten times the FY 2008 annual budget for EERE. In the context of such large increases, how can this Administration justify a budget increase for such programs at NSF? Which of these activities is being duplicated at other agencies, such as the Department of Energy?

Answer:

NSF's efforts in clean-energy research and other important priorities are clearly distinct from DOE EERE activities. NSF is the only federal agency with a mandate to support research and education in every discipline. NSF is also the primary source of support for academic research for most non-biomedical disciplines. NSF puts the greatest share of its resources into the Nation's colleges and universities. Universities are the largest performers of basic research in the United States, conducting over 50 percent of all basic research. For these reasons, the 2013 Budget request for NSF is $7.4 billion, an increase of 4.8 percent above the 2012 funding level.

Other Federal agencies support research toward these priorities of clean energy, advanced manufacturing, etc., but in complementary ways that are designed not to be duplicative. DOE's applied research and development in clean energy, for

example, focuses on developing cutting-edge technologies with real-world applications. They do so primarily by harnessing the innovative capabilities of DOE national labs and industry, in contrast to NSF's primary focus on colleges and universities.

OSTP responses House SST QFRs 4/19/12

Questions for the Record
The Honorable Randy Hultgren

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

An Overview of the Administration's Federal Research and Development Budget for Fiscal Year 2013

Friday, February 17, 2012
9:30 a.m.

QUESTIONS FOR DR. HOLDREN:

Dr. Holdren, as a constituent physicist of mine recently reminded me: Science comes in two forms: "Edisonian Science", the applications of scientific principles to build stuff, and "Einsteinian Science", the effort to discover the basic principles themselves.

Our system of free enterprise does a very good job at Edisonian science: Apple, General Electric, Intel and IBM are all examples of that. And since the Second World War, the United States has been a global leader in the public investment in "Einsteinian" science.

I am deeply troubled by the President's Budget Request (PBR) as it seems to be quite a pronounced departure from this half-century legacy of American leadership in fundamental research. Especially when High Energy Physics has made major concessions, particularly, closing down Tevatron. I have a few questions that are new and a few that were asked at the hearing that I would like for you to answer more comprehensively:

1. Basic Energy Sciences received a $110 million increase out of the $118 million within the Office of Science. Do you think this is an equitable distribution, particularly when Fermilab is cut by 8 percent in the PBR in the midst of an important transition to define a new vital U.S. role in particle physics. If you think this equitable, what are your plans for Fermilab?

Answer:

I appreciate your concern for the state of fundamental research in the United States. As I said at the hearing, the concept of equity is a difficult one to apply in making tough choices among competing scientific priorities. In this very demanding fiscal environment, the Administration tried to make judgments about where the greatest value at the margin was for an additional dollar that could be added to support research.

I believe strongly that the 2013 Budget sustains the legacy of American leadership in fundamental research. As I noted in my testimony, within a budget proposal that holds discretionary spending flat for the second year in a row as agreed to by

Congress and the President last year in the Budget Control Act, the Administration has prioritized continuing increases in Federal support for research. The Federal research portfolio totals $64.0 billion in the 2013 Budget, up $2.0 billion or 3.3 percent compared to the 2012 enacted level. The 2013 Budget also maintains the President's commitment to three key science agencies, one of which is the Department of Energy's Office of Science. Within difficult funding constraints, DOE's Office of Science would receive a 2.4 percent increase to $5.0 billion in the 2013 Budget proposal.

As I said at the hearing, the United States has derived and continues to derive tremendous benefit out of Fermilab, supported by DOE's Office of Science. We have gotten tremendous benefit out of Fermilab's Tevatron, but there are now other Energy Frontier facilities where the U.S. conducts research that are more at the cutting edge and are yielding more cutting-edge results than we could have gotten from the Tevatron. Fermilab scientists are active participants in these projects, including the A Toroidal LHC ApparatuS (ATLAS) and Compact Muon Solenoid (CMS) detectors experiments at the Large Hadron Collider (LHC). While supporting participation in these exciting new research avenues, the 2013 Budget continues to support the analysis of Tevatron data to ensure we fully exploit our investment. This analysis has already produced exciting results. During FY 2013, the Neutrinos at the Main Injector (NuMI) beamline at Fermilab will be upgraded from approximately 400 to 700 kW. DOE expects the NOvA project will be in full operation in 2014 to enable key measurements of neutrino properties.

2. The Long Baseline Neutrino Experiment (LBNE) has been extensively reviewed, including by the National Academy and has been part of the plans for the field for the last four years. The President's budget Request severely cuts LBNE and does not even provide the funds to sustain the ongoing operations at Homestake. What are the Administration's intentions with regards to LBNE, and how is this momentum-killing approach an effective use of taxpayer funding or helping to drive U.S. scientific leadership? As a reminder, the PBR support for the design of LBNE has been more than halved from FY 2012 and the Homestake mine is already operating a bare bones efficiency, and the PBR cuts it further by 33 percent to levels insufficient to maintain minimum operations.

Answer:

DOE considered both LBNE's scientific opportunities and its cost and schedule estimates in the context of planning for the overall Office of Science program. Based on these considerations, the Department determined it cannot support the LBNE project as it is currently configured. This decision is not a judgment about the importance of the science, but rather it is a recognition that the peak cost of the project as currently proposed cannot be accommodated in the current budget climate or that projected for the next decade given the discretionary funding caps in the Budget Control Act. To ensure that the U.S. continues its leadership in advancing this field while keeping our nation on a sustainable financial path, DOE

requested that Fermilab lead the community in the development of an affordable and phased approach that will enhance scientific understanding in this important field at each phase.

3. Particle physics has become a global field. It is now entering an extremely exciting phase with new discoveries from the Large Hadron Collider (LHC) and elsewhere. What role do you think the U.S. should play? Should it build and bring partners to build in the U.S. some major international facilities like either Europe or Japan or even Italy and China are now doing?

Answer:

I share your excitement at the new discoveries in the increasingly global field of particle physics coming from the Large Hadron Collider (LHC), the Daya Bay Neutrino Experiment, and elsewhere. I think the U.S. should continue to play a leadership role in the field, as the U.S. is doing even for experiments that are taking place in facilities abroad. I am confident that U.S. researchers can continue to be at the forefront of particle physics and other scientific disciplines.

4. For the DOE, the President's Budget Request is focused on energy projects in a variety of contexts. The Office of Science, within DOE, has traditionally supported the broad fabric of science in the U.S., not just efforts related to energy. Do you intend to maintain that broad spectrum of basic science, or are you working to narrow it down to applications to energy only?

Answer:

The Administration intends to continue supporting the spectrum of basic science that the DOE Office of Science currently supports and has done so in its policies and budgets. The Office of Science delivers scientific discoveries and major scientific tools that transform our understanding of nature and fulfill the DOE's mission to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. The Office of Science is both the lead Federal agency supporting fundamental scientific research for energy and the Nation's largest Federal sponsor of basic research in the physical sciences.

5. Big Data: Scientific discovery increasingly involves making sense of massive quantities of data to find the unique particle in the enormous stream of particles flying around the Large Hadron Collider, understand the chemicals that make up the universe by analyzing signals from the Atacama Large Millimeter Array, or putting together the puzzle of a genome from the jigsaw pieces provided by gene sequencing. We have many resources to tackle these challenges, such as the National Center for Supercomputing Applications at the University of Illinois. How does the budget request propose to leverage existing infrastructure to tackle these challenges and connect researchers across

disciplines?

Answer:

The 2013 Budget for the National Science Foundation (NSF) includes continuing funding for the Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21) program. CIF21 will promote new research opportunities and partnerships across all science and engineering fields by providing integrated and scalable cyberinfrastructure that will leverage existing and new components. CIF21 will also ensure long-term sustainability for cyberinfrastructure by creating communities of users and providers. It will also promote the development of a scientific workforce that will result in a greater number of scientific communities that can effectively use cyberinfrastructure to conduct research and education. This program, in coordination with the Networking and Information Technology Research and Development (NITRD) Big Data Senior Steering Group, will be issuing solicitations, running challenges, and facilitating collaboration across agencies on the type of big-data projects that you mention. The National Center for Supercomputing Applications is an example of the type of facility that will most certainly be leveraged in this effort.

Another key agency is the Department of Energy (DOE). In DOE's Office of Science, new research efforts will be supported across the Advanced Scientific Computing Research (ASCR) portfolio with a focus on addressing the challenges of data-intensive science and the massive data expected from DOE mission research including current and planned scientific user facilities. There are two broad categories in which DOE's missions lead to unique data-centric computing challenges that span the portfolios of ASCR and the other research programs:
- DOE researchers routinely compute detailed models of time-dependent, three-dimensional systems on some of the world's largest computers. These simulations generate enormous data sets that are difficult to extract and archive, let alone analyze. More comprehensive analysis of these data will help in the discovery and identification of unanticipated phenomena, and also help expose shortcomings in simulation methodologies and software.
- DOE manages the Nation's most advanced experimental resources, and these facilities generate tremendous amounts of data. Data sets generated at DOE's scientific facilities today significantly outstrip current analysis capabilities. Basic research in Applied Mathematics and Computer Science, coupled to expertise from the facilities, is required to realize the significant potential that exists in DOE facilities data.

6. Cybersecurity: With our nation's internet communications system under constant attack, advancing our cybersecurity is an urgent priority. How does the Administration propose to spur new research to stay ahead of ever innovating attackers, how will this research be connected with industries and agencies that need it to protect their systems, and how will you leverage existing resources such as the National Center for Supercomputing Applications at the University of Illinois?

Answer:

To address evolving cybersecurity threats, we have increased Federal spending on research and development to foster innovative technologies that will thwart such threats. The Networking and Information Technology Research and Development (NITRD) initiative coordinates unclassified cybersecurity R&D for 15 Federal agencies, and one of NITRD's major substantive areas is Cyber Security and Information Assurance (CSIA) research. (There is also a substantial Federal investment in classified cybersecurity R&D.) The 2013 Budget proposes $667 million for the CSIA portion of NITRD, up from $590 million for FY 2012. Additionally, in the December 2011 release of our Federal strategic R&D plan for cybersecurity, we set forth our vision for the research necessary to develop game-changing technologies. With this overarching template, we are focusing the scientific community, including industry and university partners such as the NCSA at the University of Illinois, on a common set of problems, better leveraging and targeting our Federal R&D investments and accelerating the pace of bringing the positive results of our Federal R&D investments into practice in the marketplace.

OSTP responses House SST QFRs 4/19/12

Questions for the Record
The Honorable Donna Edwards

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

An Overview of the Administration's Federal Research and Development Budget for Fiscal Year 2013

Friday, February 17, 2012
9:30 a.m.

QUESTIONS FOR DR. HOLDREN:

1. Forensic Science: As you may be aware, we just passed the 3rd anniversary of the release of the National Academies' report, Strengthening Forensic Science in the United States: A Path Forward. In the wake of that report, a Subcommittee on Forensic Science was created at the National Science and Technology Council to assess the report and to advise the White house on how best to achieve the goals outlined in it. While I am very pleased that the NIST budget for FY 2013 includes additional funding to enhance the scientific validity of forensic science methods and practices, I am wondering whether we can expect the Subcommittee's work to result in any additional Administration efforts in this important area.

Answer:

The Executive Office of the President (EOP) is committed to improving forensic science. As you mention, the Cabinet-level, interagency National Science and Technology Council has a chartered subcommittee that has been developing approaches to respond to the specific recommendations in the 2009 National Academies report. That subcommittee has developed a number of draft recommendations for action that are in the process of being reviewed and finalized.

OSTP responses House SST QFRs 4/19/12

Questions for the Record
The Honorable Frederica Wilson

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

An Overview of the Administration's Federal Research and Development Budget for Fiscal Year 2013

Friday, February 17, 2012
9:30 a.m.

QUESTIONS FOR DR. HOLDREN:

I am glad to have learned of the recent work of the President's Council of Advisors on Science and Technology (PCAST) who released a report earlier this month on STEM education. As we digest this report and build our strategies, I would urge OSTP and the President to not let a special emphasis on underrepresented minorities get "lost in the weeds." This banner needs to be raised up and waved quite boldly.

We are at the point in time where everyone is "on the hook" – not only to produce more STEM graduates… but more minority STEM graduates. K-12, Higher Ed, Science and Technology Industries, etc. Because the strategies and solutions need to rest with inspiring young minds at the youngest of years ensuring our K-12 science and math teachers are inspired scientists and mathematicians themselves; teaching by doing, touching, doing, experimenting (contextual learning); redesigning K-12 and higher ed classes so that we're not "weeding students out" but bringing them into the fold; and of course ensuring many pathways to internships early on and ultimately employment.

And for all its worth, this is not a one-size-fits-all issue. Our underrepresented minorities and communities serving them need strategies that will work for them and meet the national need.

I understand that the President will be setting up a special Presidential Council on STEM Education, a recommendation included in the report on Undergraduate STEM education. I would like to urge you to make sure that leaders who are especially focused on increasing diversity in the STEM fields are represented on the Council. I have been extremely impressed, for example, with the work that Mark Rosenberg has been doing in my own district as President of Florida International University, the largest Hispanic-Serving University in the nation, but also one of the largest producers of STEM degrees for all minorities, including African-American engineers.

I know your assistant Director Dr. Wieman had a chance to visit recently.

At FIU, they are transforming the STEM landscape: redesigning introductory courses across the board – Physics, Chemistry, Biology – to greater success, 20-30% increases in

some cases. And these are gateway courses – the PCAST report points out that focusing on the first two years is the cheapest and most effective way to meet our need. Physics graduates at FIU, for example – in a majority minority community – have increased by 350% recently. Not only are they producing more grads… but more STEM teachers who are going into K-12 and helping change the course by inspiring the youngest minds. And with everyone else at the table: K-12, Community Colleges, private sector.

I believe that people like mark would offer a unique perspective and be a huge asset to the work of the Council.

1. Could you tell me more about what the decision-making process will be and a potential timeline for appointments to the Council?

Answer:

Thank you, Congresswoman, for your thoughts on STEM education. I am pleased to read your expression of support for PCAST's work on this topic. I assure you that we will not lose focus on the importance of improving STEM-education experiences and opportunities for underrepresented minorities in our efforts. I have said on many occasions that the President called this point in time an 'all hands on deck' moment for STEM education, when we must do all we can to make sure that our students have the skills and educations needed to become the highly-skilled workforce of the future. And "all hands" means ALL hands. The Administration recognizes that the United States cannot win the future without all our students, especially the growing proportion of our students who are members of underrepresented minority groups.

I agree that our underrepresented minority students come from distinctive backgrounds and communities, and thus need distinctive strategies rather than a one-size-fits-all approach. PCAST members and my OSTP colleagues have benefited greatly from learning about the many efforts underway in campuses across the nation to do better at attracting and retaining interested students in STEM fields, to improve teaching of STEM subjects, and to create supportive pathways to careers in STEM fields. Dr. Carl Wieman, OSTP's Associate for Director for Science, had occasion to visit Florida International University in your district recently, and he speaks highly of the successful strategies FIU has employed to become one of our nation's top institutions for encouraging, retaining, and graduating minority STEM students. FIU is the largest Hispanic Serving Institution (HSI) in the nation and, as you point out, one of the top institutions for African-American STEM graduates. FIU's transformational strategies are closely aligned with the Administration's efforts to improve the Federal government's STEM-education efforts.

As I stated in my testimony, I have submitted to Congress a progress report on our efforts leading toward the release of a Federal STEM Education Strategic Plan later this spring. The progress report and key proposals in the 2013 Budget for STEM education reflect some of the recommendations of the PCAST Undergraduate STEM Education report released in February. At this time, we are still deliberating on other recommendations of the PCAST report such as the recommendation to establish a Presidential Council on STEM Education. Therefore, it would be premature for me to talk about plans for a Council at this time. I will, however, keep you informed of our ongoing responses to the PCAST report and look forward to working with you on improving STEM education and access to STEM careers for all Americans.

Appendix II

Additional Material for the Record

WEBSITE LINK TO EPA'S COST-BENEFIT ANALYSIS OF RECENTLY RELEASED MERCURY RULE AS SUBMITTED BY THE HONORABLE JOHN P. HOLDREN, DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502

February 28, 2012

The Honorable Lamar Smith
U.S. House of Representatives
2409 Rayburn HOB
Washington, D.C. 20515

Dear Congressman Smith,

At the February 17 hearing of the House Science, Space and Technology Committee you asked for my assistance in obtaining documents relating to EPA's cost-benefit analysis of the recently released mercury rule.

My staff located the relevant report on the EPA website. Since the report is more than 500 pages long, I am providing here a link to the Web page so you can access the report directly: http://www.epa.gov/ttn/ecas/regdata/RIAs/matsriafinal.pdf

Please let me know if you have additional questions.

Sincerely,

John P. Holdren

John P. Holdren
Director

Cc: The Honorable Ralph Hall
The Honorable Eddie Bernice Johnson

○