

**AN OVERVIEW OF THE ADMINISTRATION'S
FEDERAL RESEARCH AND DEVELOPMENT BUDGET**

HEARING
BEFORE THE
**COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY**
HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

FEBRUARY 17, 2011

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**AN OVERVIEW OF THE ADMINISTRATION'S
FEDERAL RESEARCH AND DEVELOPMENT
BUDGET**

THURSDAY, FEBRUARY 17, 2011

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

The Committee met, pursuant to call, at 11:38 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Ralph Hall [Chairman of the Committee] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

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

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*An Overview of the Administration's Federal Research and Development Budget
for Fiscal Year 2012*

Thursday, February 17, 2011

10:00 a.m.-12:00 p.m.

2318 Rayburn House Office Building

Witnesses

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 2012*

Thursday, February 17, 2011
10:00 a.m. - 12:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Thursday, February 17, 2011, the House Committee on Science, Space, and Technology will hold a hearing to examine President Obama’s proposed fiscal year 2012 (FY12) 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 FY12 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 OSTP, the White House science office. 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.

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4. Overview

Overall Budget

Under the President's proposed budget for FY12, overall discretionary spending would decrease by 1.1 percent if Overseas Contingency Operations and Other Supplemental/Emergency Funding are included; otherwise, base discretionary spending would increase by 8.9 percent. These increases are weighted toward spending on defense and homeland security. A majority of other agencies see a reduction in discretionary spending. However, within the Committee's jurisdiction, the Department of Energy's Office of Science (9 percent), the National Science Foundation (13 percent), the National Institute of Standards and Technology (17 percent), and the National Oceanic and Atmospheric Administration (13 percent) are exceptions. Discretionary spending for NASA remains flat.

Research and Development (R&D) Budget

Overall Federal Research and Development Spending¹ (dollars in millions)

Agency	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Enacted	
					\$	%
Department of Defense	80287	80602	77548	76633	(3969)	(5)
Department of Health and Human Services	29265	31424	32156	32343	919	33
Department of Energy	9807	10836	11219	12989	2153	20
NASA	11182	9262	10986	9821	559	6
National Science Foundation	4580	5445	5571	6320	875	16
Department of Agriculture	2336	2611	2448	2150	(461)	(18)
Department of Commerce	1160	1344	1727	1720	376	28
Department of Transportation	875	1069	1180	1215	146	14
Department of Homeland Security	995	887	1046	1054	167	19
Department of Veterans Affairs	960	1162	1018	1018	(144)	(12)
Department of the Interior	683	776	772	727	(49)	(6)
Environmental Protection Agency	551	590	651	579	(11)	(2)
Department of Education	-	353	383	480	127	36
Smithsonian Institution	-	213	236	212	(1)	-
Other	1074	565	755	650	85	15
Totals:	143746	147139	147696	147911	772	1

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

The President's FY12 budget proposes a total of \$147.9 billion for research and development (R&D) across all agencies, a \$772 million or one percent increase over the FY10 enacted level.²

¹ Fiscal Year 2012 Analytical Perspectives, Budget of the U.S. Government, OMB, p. 367.
(<http://www.whitehouse.gov/sites/default/files/omb/budget/fy2012/assets/spec.pdf>)

The budget would decrease defense-related R&D spending by \$3.96 billion or five percent to \$76.6 billion and increase health-related R&D by \$919 million or three percent to \$32.3 billion. Therefore, the total non-defense R&D budget request is \$71.2 billion, but the total FY12 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 \$38.9 billion or a 10.8 percent increase over the FY10 enacted level. This amount includes basic and applied research, development, and facilities and equipment.

The President's proposed FY12 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 \$13.9 billion for the three physical science 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 Environmental Protection Agency (EPA) R&D activities, which would be cut by two percent, and National Aeronautics and Space Administration (NASA) R&D, which would increase by six percent, all other agencies within the Committee's jurisdiction receive significant increases of 14 percent or more.

5. Interagency Research Activities³

Interagency Research Activities Spending (dollars in millions)

Interagency Program	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Actual	
					\$	%
National Nanotechnology Initiative (NNI)	1549	1931	1776	2132	201	10.4
Networking and Information Technology R&D (NITRD)	3572	3794	4261	3868	74	2
US Global Change Research Program (USGCRP)	1832	2122	2561	2568	446	20.3

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 26 federal agencies that participate in NNI, with 15 of those agencies reporting a nanotechnology R&D budget. The House passed two measures that included reauthorization for the NNI program in the 110th Congress (H.R. 554, the National

² The FY10 enacted level does not include any carryover from the estimated \$21.5 billion in R&D funding in the American Recovery and Reinvestment Act (ARRA) (P.L. 111-5), which included \$10.4 billion for NIH; \$3.0 billion for NSF; \$5.5 billion for DOE; \$580 million for NIST; \$1.0 billion for NASA; and \$830 million for NOAA.

³ Budget numbers and details for the NNI and NITRD programs are taken from the Innovation, Education and Infrastructure Fact Sheet provided by OSTP. (<http://www.whitehouse.gov/sites/default/files/microsites/ostp/FY12-rd-fs.pdf>). Details may change with the release of the Supplement to the budget for these two programs, which had not been cleared by OMB at time of charter publication.

Nanotechnology Initiative Amendments Act, and H.R. 5116, the America COMPETES Reauthorization Act). The Senate did not take up H.R. 554, and the NNI provision was dropped from the Senate-passed version of H.R. 5116, which was signed into law (P.L. 111-358).

The FY12 budget request for NNI is \$2.1 billion, an increase of \$201 million or 10.4 percent over the FY10 actual levels. The Administration's budget request includes 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 \$611 million, a \$237 million or 63 percent increase. Likewise, NASA sees a 64 percent increase, EPA an 11.9 percent increase, HHS a five percent increase, NSF a 2.5 percent increase and NIST a one percent increase. All other agency funding is reduced by a total of \$88 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, 13 Federal agencies contribute funding to the NITRD program and additional agencies, such as the Department of Homeland Security (DHS), participate in planning activities. The House passed two reauthorization measures for the NITRD program in the 110th Congress (H.R. 2020, the Networking and Information Technology Research and Development Act, and H.R. 5116, the America COMPETES Reauthorization Act). The Senate did not take up H.R. 2020, and the NITRD provision was dropped from the Senate-passed version of H.R. 5116, which was signed into law.

The FY12 NITRD budget request is \$3.9 billion, a \$474 million or two percent increase over the FY10 actual level. The Administration request emphasizes the need for networking and computing capabilities for homeland security, reforming the health care system, understanding and responding to environmental stresses, increasing energy efficiencies and developing renewable energy sources, and revitalizing the educational system for the jobs of tomorrow. The Department of Defense (DOD) contribution is decreased by \$261 million or 19.9 percent, primarily from earmarks. NSF and DOE both have significant increases of \$153 million and \$108 million respectively. DHS has a 69.7 percent increase, the Department of Commerce has a 49.3 percent increase, and NASA has an 11 percent increase.

Global Change Research Program (USGCRP)

The FY12 budget requests \$2.6 billion for the interagency USGCRP, a \$446 million or 20.4 percent increase over FY10 enacted, 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.

6. Agency R&D Highlights

National Aeronautics and Space Administration (NASA)

National Aeronautics and Space Administration (NASA) Spending (dollars in millions)

Account	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Enacted	
					\$	%
Science Mission Directorate	4706.2	4493.3	5005.6	5016.8	523.5	11.6
<i>Earth</i>	1280.3	1420.7	1801.8	1797.4	376.7	26.5
<i>Planetary</i>	1247.5	1341.3	1485.7	1540.7	199.4	14.8
<i>Astrophysics</i>	1337.5	1103.9	631.5 [^]	682.7	(421.2)	(38.2)
<i>James Webb Space Telescope</i>	545.4	441.4	444.8 [^]	373.7	(67.7)	(15.3)
<i>Heliophysics</i>	840.9	627.4	641.9	622.3	(5.1)	(0.8)
Aeronautics	511.7	507.0	579.6	569.4	62.4	12.3
Space Technology	--	0.0	572.2	1024.2	1024.2	--
Exploration	3143.1	3779.8	4263.4	3948.7	168.9	4.5
<i>Exploration R&D</i>	--	0.0	1551.4	288.5	--	--
<i>Human Spaceflight Capabilities</i>	--	0.0	0.0	2810.2	--	--
<i>Commercial Spaceflight</i>	--	0.0	812.0	850.0	--	--
<i>Advanced Capabilities</i>	671.1	454.0	0.0	0.0	--	--
<i>Constellation Systems</i>	2471.9	3325.8	1900.0 [*]	--	--	--
Space Operations	5526.2	6180.6	4889.7	4346.9	(1833.7)	(30.0)
<i>International Space Station</i>	1813.2	2317.0	2779.8	2841.5	524.5	22.6
<i>Space Shuttle</i>	3266.7	3139.4	989.1	664.9	(2474.5)	(78.8)
<i>Space & Flight Support</i>	446.3	724.2	1119.0	840.6	116.4	16.1
Education	146.8	183.8	145.8	138.4	(45.4)	(24.7)
Cross-Agency Support	3242.9	3095.1	3111.4	3192.0	96.9	3.1
Construction & Environmental Compliance	--	448.3	379.3	450.4	2.1	0.4
Inspector General	32.6	36.4	37.0	37.5	1.1	3.0
Totals:	17309.4	18724.3	19000.0	18724.3	0.0	0.0

^{*}To cover program shut-down costs.

[^]The FY11 request did not break out JWST from Astrophysics. To allow for comparison with FY12, the FY11 request has been redisplayed.

The FY12 budget request for NASA is \$18.7 billion, the same amount requested in FY10. Congress fully funded the agency's request in the FY10 appropriations bill, a level which has continued to this day. For the four-year runout (FY13 – FY16), NASA's budget projection assumes identical funding for each year – \$18.7 billion. However, the Office of Management and Budget (OMB) Blue Book and NASA's own budget request disagree on out-year funding levels; NASA's assumes four years of flat funding at \$18.7 billion; OMB's out-year projections indicate budgets that are below the FY12 request.

The budget request assumes retirement of the Space Shuttle in FY11 and provides \$548 million in FY12 to cover pension costs associated with the contractor workforce that maintained the Shuttle fleet. The budget request also assumes operation and utilization of the International Space Station through at least 2020. NASA's FY12 budget proposes \$2.8 billion for development of the Congressionally-directed Space Launch System and the Orion-based Multi Purpose Crew Vehicle, which is \$1.2 billion less than authorized in the NASA Authorization Act of 2010 (P.L. 111-267). The 2010 Act reflected 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 should commercial crew and cargo capabilities fail to materialize. Furthermore, the FY12 budget proposal diverges from Congressional direction by seeking \$1.7 billion over two years (FY12 and FY13) for commercial crew, which is \$700 million above authorized levels. The proposal also tries to reinstate funding for the 21st Century Launch Complex, an initiative that Congress rejected in last year's bill.

The FY12 budget request responds to the NASA Authorization Act of 2010 (P.L. 111-267) in the area of science. The request reflects the scientific priorities of the National Research Council's decadal survey for Astrophysics. Because of the high scientific importance of the troubled James Webb Space Telescope (JWST) still under development, NASA has created a separate JWST line in its budget request to give the program closer scrutiny. Last summer an external review panel determined that JWST would require an additional \$1.5 billion in funding and an additional year of schedule before it would be ready for launch. NASA is currently performing a bottoms-up review, and for FY12 is requesting a reduction for JWST while it awaits final analysis.

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

Program	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Enacted	
					\$	%
Office of Science	4083.0	4964.0	5121.0	5416.0	452.0	9.11
<i>Advanced Scientific Computing Research</i>	351.0	383.2	426.0	465.6	82.4	21.5
<i>Basic Energy Sciences</i>	1270.0	1599.0	1835.0	1985.0	386.0	24.1
<i>Biological and Environmental Research</i>	544.0	588.0	627.0	717.9	129.9	22.1
<i>Fusion Energy Sciences</i>	287.0	417.7	380.0	399.7	(18.0)	(4.3)
<i>High Energy Physics</i>	689.0	790.8	829.0	797.2	6.4	0.8
<i>Nuclear Physics</i>	433.0	522.5	562.0	605.3	82.8	15.9
Energy Efficiency and Renewable Energy (EERE)	1704.0	2242.5	2355.0	3200.0	957.5	42.70
<i>Hydrogen Technology</i>	211.1	170.3	0.0	0.0	(170.3)	(100)
<i>Hydrogen and Fuel Cell Technologies</i>	0.0	0.0	137.0	100.5	100.5	n/a
<i>Biomass and Biorefinery Systems</i>	198.2	216.2	220.0	340.5	124.3	57.5
<i>Solar Energy</i>	168.5	243.4	302.4	457.0	213.6	87.8
<i>Wind Energy</i>	49.6	79.0	122.5	126.9	47.9	60.6
<i>Geothermal Technology</i>	19.8	43.1	55.0	101.6	58.5	135.7
<i>Water Power</i>	9.9	48.7	40.5	38.5	(10.2)	(20.9)
<i>Vehicle Technologies</i>	213.0	304.2	325.3	588.0	283.8	93.3
<i>Building Technologies</i>	109.0	219.0	230.7	470.7	251.7	114.9
<i>Industrial Technologies</i>	64.4	94.3	100.0	319.8	225.5	239.1
Nuclear Energy R&D	438.0	487.0	396.0	447.4	(39.6)	(8.1)
Electricity Delivery and Energy Reliability R&D	82.8	168.5	144.3	192.8	24.3	14.4
Fossil Energy R&D	888.5	659.3	760.0	453.0	(206.3)	(31.3)
ARPA-E[*]	n/a	0.0	300.0	650.0	650.0	n/a
Loan Guarantee Program Office	4.6	0.0	0.0	305.0	305.0	n/a
Totals:	7200.9	8521.3	8776.3	10014.2	1492.9	14.9

*\$100 million of the \$650 million ARPA-E request is proposed to be paid for through revenues collected from auction of wireless broadcast spectrum.

The Department of Energy 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 total FY12 budget request for the Office of Science (SC) is \$5.4 billion, a \$452 million or 9.1 percent increase over FY10 enacted and a \$295 million increase over the Administration's FY11 request. The mission of the Office of Science is the delivery of scientific discoveries, capabilities, and major scientific tools to transform the understanding of nature and to advance the energy, economic, and national security of the United States. In support of this mission, SC supports basic research in the following areas: advanced scientific computing, basic energy sciences, biological and environmental research, fusion energy sciences, high energy physics, and nuclear physics. SC's activities 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. The Office of Science also supports several ongoing interagency initiatives such as the interagency NITRD program; the NNI; the USGCRP; and the Climate Change Technology Program (CCTP).

Advanced Research Projects Agency – Energy (ARPA-E)

The Administration requests \$650 million for the Advanced Research Projects Agency – Energy (ARPA-E). Of this amount, \$550 million would be provided through discretionary funding. ARPA-E would also administer an additional \$100 million Wireless Innovation Fund (WIN) aimed at developing wireless communications technologies and paid for through a proposed transfer of wireless spectrum auction revenues.

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." 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 was the beneficiary of a \$15 million transfer from the Office of Science.

In 2010, ARPA-E issued \$207.6 million in ARRA funds for 85 projects. These projects were awarded as a result of two funding opportunities. The six program areas funded in 2010 included Electrofuels, Batteries for Electrical Energy Storage in Transportation (BEEST), Innovative Materials & Processes for Advanced Carbon Capture Technologies (IMPACCT), Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS), Agile Delivery of Electrical Power Technology (ADEPT), and Building Energy Efficiency Through Innovative Thermodevices (BEET-IT).

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, development, and demonstration as appropriate."⁴

⁴ All DOE mission statement quotes come from the cited office's website.

The FY12 budget request for NE R&D is \$447.4 million, a \$39.6 million or 8.1 percent decrease from FY10 enacted and a 10 percent decrease from the FY11 President's budget request. Approximately 74 percent of that request is dedicated to the Fuel Cycle R&D and Reactor Concepts RD&D programs.

The President's request includes funding for two new programs, \$97 million for Nuclear Energy Enabling Technologies (NEET) and \$67 million for a Small Modular Reactor Deployment program. NEET is intended to develop cross cutting technologies which can be applied to multiple reactor concepts and fuel cycle approaches. The Small Modular Reactor Deployment program is created to assist in the development and licensing of small modular reactors necessary for commercial deployment.

Energy Efficiency and Renewable Energy (EERE)

The mission of Energy Efficiency and Renewable Energy (EERE) is to "strengthen the United States' energy security, environmental quality, and economic vitality in public-private partnerships." EERE's stated goal is to support this mission through the following means: "Enhancing energy efficiency and productivity; Bringing clean, reliable and affordable energy technologies to the marketplace; and Making a difference in the everyday lives of Americans by enhancing their energy choices and their quality of life."

The Administration's budget request of \$3.2 billion for the Office of Energy Efficiency and Renewable Energy (EERE) represents a \$958 million or 44.4 percent increase from the FY10 enacted level and a \$845 million or 36 percent increase over the President's FY11 budget request. This reflects the President's call in his State of the Union speech for increased spending on clean energy technologies. Most EERE programs receive significant funding increases relative to the FY10 enacted level. Industrial Technologies receives a \$225 million or a 239 percent increase, which includes the creation of an Energy Innovation Hub on critical materials. Geothermal Technology would see an increase of \$58 million or 125 percent to expand the enhanced geothermal subprogram and Solar Energy would receive an additional \$213 million or 87.8 percent to fund the "Sunshot" and "dollar-a-watt" initiatives.

Electricity Delivery and Energy Reliability

The mission of the Office of Electricity Delivery and Energy Reliability (OE) is to "lead national efforts to modernize the electric grid; enhance security and reliability of the energy infrastructure; and facilitate recovery from disruptions to energy supply." Research and Development within OE would be funded at \$193 million in the President's FY12 budget request. This would reflect an increase of \$71.4 million or 58.8 percent from FY10 enacted levels and a \$48.5 million increase or 33.6 percent from the President's FY11 budget request. Additionally, the President requests \$20 million for the creation of a Smart Grid Technology and Systems Hub to be administered by OE.

Fossil Energy

The DOE Office of Fossil Energy (FE) supports R&D focused on coal (including clean coal technologies), gas, and petroleum and also supports the Federal government's Strategic Petroleum Reserve. The President's total budget request for the FE is \$520 million. FE's R&D

budget is reduced to \$453 million, a decrease of \$206 million or 31.3 percent from FY10 enacted levels. This correlates to a \$134 million or 22.3 percent decrease from the President's FY11 budget request.

The FY12 budget request proposes to terminate the Natural Gas Technologies and Unconventional Fossil Energy Technologies programs. Coal R&D is funded at \$291 million, the bulk of which is focused on advancing carbon capture and sequestration (CCS) efforts. The Hydrogen from Coal, Coal to Coal Biomass to Liquids, and Solid Oxide Fuel Cells subprograms would all be eliminated.

Energy Innovation Hubs

The FY12 budget request proposes funding of \$146 million for support six Energy Innovation Hubs, which are supported through the SC, EERE, and NE accounts. This would support the three existing Hubs and as well as the creation of three new Hubs, which the President highlighted in his recent State of the Union address. According to the Administration, Hubs are intended to "advance highly promising areas of energy science and engineering from the early stage of research to the point where the technology can be handed off to the private sector."⁵ The newly proposed Hubs are Batteries and Energy Storage (administered by the Office of Science, Basic Energy Sciences), Smart Grid Technology and Systems (administered by OE), and Critical Materials (administered by the Industrial Technologies Program at EERE).

Loan Guarantee Program Office

The President's FY12 budget request for DOE's Loan Guarantee Program Office (LPO) is \$200 million. This funding would be used as a credit subsidy for loans authorized under Section 1703 of the Energy Policy Act of 2005. The LPO did not receive an appropriation for credit subsidies in FY10. The credit subsidy funding would support an estimated \$1 to \$2 billion in loan guarantees to support energy efficiency and renewable energy activities.

Since its creation, the LPO has awarded over \$17.6 billion for 18 projects, in a wide variety of sectors such as solar generation, solar manufacturing, wind generation, wind manufacturing, geothermal, and transmission and energy storage.

In addition to the Title 17 loan guarantees, the President is requesting \$105 million to for the creation of a Better Building Pilot Loan Guarantee Initiative for Universities, Schools, and Hospitals. This program would fund loan guarantees to help retrofit commercial buildings and would be available to subsidize up to \$2 billion in total loan principal.

⁵ <http://www.energy.gov/hubs/>

National Science Foundation (NSF)**National Science Foundation (NSF) Spending**
(dollars in millions)

Account	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Enacted	
					\$	%
Research and Related Activities (RRA)	4853.2	5563.9	6018.8	6253.5	689.6	12.4
<i>Biological Sciences (BIO)</i>	615.6	714.5	767.8	794.5	79.6	11.2
<i>Computer and Info. Science and Engineering (CISE)</i>	535.3	618.8	684.5	728.4	109.6	17.7
<i>Engineering (ENG)</i>	649.5	743.9	825.7	908.3	164.4	22.1
<i>Geosciences (GEO)</i>	757.9	889.6	955.3	979.2	89.5	10.1
<i>Mathematical and Physical Sciences (MSP)</i>	1171.1	1351.8	1409.9	1432.7	80.9	6.0
<i>Social, Behavioral, and Economic Sciences (SBE)</i>	227.9	255.3	268.8	301.1	45.9	18.0
<i>Cyberinfrastructure (OCI)</i>	185.2	214.3	228.1	236.0	21.7	10.1
<i>International Science and Engineering (OISE)</i>	47.8	47.8	53.3	58.0	10.2	21.3
<i>Polar Programs (OPP)</i>	447.1	451.2	527.9	477.4	26.3	5.8
<i>Integrative Activities (IA)</i>	214.5	275.0	295.9	336.3	61.2	22.3
<i>U.S. Arctic Research Commission</i>	1.5	1.6	1.6	1.6	0	1.3
Education and Human Resources (EHR)	766.3	872.8	892.0	911.2	38.4	4.4
Major Research Equipment & Facilities Const (MREFC)	166.9	117.3	165.2	224.7	107.4	91.6
Agency Operations & Award Management	282.0	300.0	329.2	357.7	57.7	19.2
National Science Board (NSB)	3.8	4.5	4.8	4.8	.3	6.6
Office of Inspector General (OIG)	11.8	14.0	14.4	15	1.0	7.1
Totals:	6084.0	6872.5	7424.4	7767.0	894.5	13.0

The FY12 budget request for NSF is \$7.7 billion, an increase of 13 percent, or \$894.5 million over the FY10 enacted level (not including any carryover from the \$3 billion NSF received from ARRA funding). The request continues to keep NSF on a doubling path for funding as set out in the America COMPETES Act and America COMPETES Reauthorization Act. NSF provides approximately 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 approximately 40 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 FY12 budget request includes \$6.3 billion for Research and Related Activities (RRA), an increase of \$690 million or 12.4 percent over FY10 enacted. 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 get significant increases in the FY12 budget request ranging from six percent for MPS to 22.1 percent for ENG. New programs established as part of the increased research funding request for FY12 include \$35 million for a nanotechnology manufacturing initiative, \$40 million in next-generation robotics technologies, and \$96 million for an interdisciplinary program to eventually replace computer chip technologies. In addition, \$87 million is requested for advanced manufacturing activities including expanded university-industry research partnerships and regional innovation ecosystems and clean energy manufacturing research. Another \$117 million is requested for “cyber-infrastructure” activities to accelerate the pace of discovery and \$12 million for a “new program that will fund a suite of activities that promote greater interdisciplinary research.”

As part of the Science, Engineering and Education for Sustainability (SEES) program that 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 FY12 budget request is \$998.1 million, an increase of \$337.5 million or 51 percent.

In addition, the FY12 budget request also includes a plan to invest broadband spectrum receipts in a variety of areas, including \$150 million to NSF in FY12 and \$1 billion total over a 5-year period for targeted research on experimental wireless technology testbeds, more flexible and efficient use of the radio spectrum, and cyber-physical systems such as wireless sensor networks for smart buildings, roads, and bridges. NSF’s participation is a piece of the \$3 billion WIN fund.

Education and Human Resources (EHR)

The FY12 budget request for Education and Human Resources (EHR) is \$911 million, a \$38.4 million or 4.4 percent increase over FY10. The Administration continues to offer a mixed message regarding the treatment of EHR relative to the healthy increase for RRA. While calling for an investment of \$3.4 billion in STEM education activities across the federal government, a number of proven NSF initiatives are being eliminated, reduced, or reprogrammed to make way for new or expanded programs. Like last year’s request, the FY12 budget request continues to shift a greater responsibility for STEM education to the Department of Education while maintaining NSF primarily as a research agency.

New funding in the FY12 budget request includes an additional \$20 million for a Transforming Broadening Participation through STEM (TBPS) pilot program to seek innovative solutions for broadening participation in STEM at the undergraduate level. This is part of an overarching realigned program called Broadening Participation at the Core (BPAC), which also houses several underrepresented population programs. The BPAC program total request is \$156 million, a \$21 million or 23.3 percent increase over FY10. Research programs focused on gender and persons with disabilities have been moved from this Division to the Division of Research on Learning in Formal and Informal Settings and funding under the request is cut by 8.7 percent to \$17 million.

Additionally, the FY12 budget request includes \$40 million in funding for a new teacher-training research and development program, split evenly between K-12 teachers and undergraduate teachers. At the same time, the budget request for Noyce Scholarships is \$45 million, a decrease of \$10 million or 18.2 percent and the Math and Science Partnership is \$48.2 million, also a decrease of \$10 million or 17.2 percent. Likewise, the Administration's budget request places a high priority on Graduate Research Fellowships (GRF) by increasing the funding to \$134.6 million, a 31.2 percent increase over FY10, while essentially flatlining the Integrative Graduate Education and Research Traineeship Program (IGERT) at \$30.17 million and greatly diminishing the Graduate STEM Fellows in K-12 Education (GK-12) to \$27 million, a 45 percent cut.

Major Research Equipment and Facilities Construction (MREFC)

The FY12 budget request includes \$224.7 for the Major Research Equipment and Facilities Construction (MREFC) account. This is a 91.6 percent increase from FY10, but the FY10 amount does not include \$146 million provided in ARRA funding for the Advanced Technology Solar Telescope (ATST). A bulk of MREFC funding in FY12 includes \$87.9 million for the second year construction of the National Ecological Observatory Network (NEON), which will collect data across the U.S. on the impacts of climate change, land use change, and invasive species. Another \$102.8 million is requested for the fourth year of construction of the Ocean Observatories Initiative (OOI), an integrated network of instrumentation that will provide continuous and interactive access to the ocean. OOI also received \$157 million in ARRA funding in FY09.

National Institute of Standards and Technology (NIST)

National Institute of Standards and Technology (NIST) Spending *(dollars in millions)*

Account	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Enacted	
					\$	%
Scientific & Technical Research and Services (STRS)	440.5	515.0	584.5	678.9	163.9	31.8
Construction of Research Facilities (CRF)	160.5	147.0	124.5	84.6	(62.4)	(42.4)
Industrial Technology Service (ITS)	154.8	194.6	209.6	237.6	43.0	22.1
<i>Technology Innovation Program (TIP)</i>	<i>65.2</i>	<i>69.9</i>	<i>79.9</i>	<i>75.0</i>	<i>5.1</i>	<i>7.3</i>
<i>Manufacturing Extension Partnership (MEP)</i>	<i>89.6</i>	<i>124.7</i>	<i>129.7</i>	<i>142.6</i>	<i>17.9</i>	<i>14.4</i>
<i>Advanced Manufacturing Consortia*</i>	<i>--</i>	<i>--</i>	<i>--</i>	<i>12.3</i>	<i>12.3</i>	<i>100.0</i>
<i>Baldrige Performance Excellence Program**</i>	<i>7.9</i>	<i>9.6</i>	<i>9.9</i>	<i>7.7</i>	<i>(1.9)</i>	<i>(19.8)</i>
Totals:	755.8	856.6	918.6	1001.1	144.5	16.9

*new initiative

**in FY11 funded under STRS account

In FY12, the Administration has requested a funding level of \$1 billion or a 16.9 percent increase from FY10 enacted funding for the National Institute of Standards and Technology (NIST). The

budget request would provide \$678.9 million for NIST's core Scientific and Technical Research and Services (STRS); \$84.6 million for Construction of Research Facilities (CRF); \$142.6 million for the Manufacturing Extension Partnership (MEP) program; and \$75.0 million for the Technology Innovation Program (TIP).

Research and Facilities

The FY12 NIST budget request is \$678.9 million for the Agency's Scientific and Technical Research Services (STRS), an increase of \$163.9 million or 31.8 percent, and includes \$168 million in specific initiatives to address national priorities related to cyber infrastructure, technology interoperability, nanotechnology, and advanced manufacturing and materials. The STRS FY12 request continues the Administration's plan to double funding for key basic research agencies.

The FY12 budget request for Construction of Research Facilities (CRF) is \$84.6 million, a 42.4 percent decrease from FY10 enacted. The significant decrease represents the completion of several major renovation projects at the laboratory facilities in Boulder, CO. CRF funding would support maintenance and repair of existing NIST buildings as well as continue the interior renovation efforts of the Boulder lab Building 1 (\$25.4 million).

Industrial Technology Services (ITS)

The \$142.6 million request for the Manufacturing Extension Partnership (MEP) program is a \$17.9 million or 14.4 percent increase from the FY10 enacted 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 requested increase would expand the program in support of the Administration's initiatives to reinvent domestic manufacturing to create jobs and respond to future challenges and opportunities.

The FY12 request for the Technology Innovation Program (TIP) is \$75 million, a \$5.1 million increase over FY10 enacted. TIP awards cost-shared grants to small companies and joint ventures for the development of high-risk, high-reward technologies that meet critical national needs. This program was created by the 2007 America COMPETES Act but was not reauthorized in the 2010 America COMPETES Reauthorization Act (P.L. 111-358).

The Baldrige Performance Excellence Program (BPEP) would receive \$1.9 million less than FY10 enacted in the FY12 budget request, reflecting the Administration's goal of transitioning the program to privately funded sources. Baldrige provides criteria and evaluation of successful strategies and performance practices across an array of industries.

New in FY12 is the Advanced Manufacturing Technology Consortia (AMTech) Program, with a \$12.3 million request. Modeled after the Nanoelectronics Research Initiative (NRI), a partnership between NSF, NIST, industry, and universities across the nation, the AMTech program would align industry needs with university research in innovative manufacturing. The program would fund facilities, equipment, and research at universities and government laboratories to address long-term research needs of the manufacturing industry.

Public Safety Innovation Fund

The FY12 budget request includes a plan to invest broadband spectrum receipts in a variety of areas, including \$100 million annually provided to NIST for 2012-2016 for research supporting the development and promotion of wireless technologies to advance public safety, Smart Grid, and other broadband capabilities. NIST's participation is a piece of the \$3 billion WIN fund.

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

Account	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Enacted	
					\$	%
National Ocean Service	536.0	578.7	550.6	558.6	(20.1)	(3.5)
Oceanic and Atmospheric Research	398.0	449.1	464.9	212.0	(237.1)	(52.8)
National Weather Service	911.0	999.8	1003.2	988.0	(11.8)	(1.2)
National Environmental Satellite Data Information Service	955.0	1398.5	2209.0	2015.4	616.9	44.1
Climate Service	0.0	0.0	0.0	346.2	346.2	100.0
National Marine Fisheries Service	829.0	1008.2	992.4	997.5	(10.7)	(1.1)
Program Support	446.0	485.9	515.1	524.8	38.9	8.0
Transfers/Rescissions		(24.8)	(50.3)	(144.8)		
Totals:	4075.0	4748.4	5554.5	5497.7	749.3	15.8

The National Oceanic and Atmospheric Administration's (NOAA) budget request for FY12 is \$5.5 billion, an increase of \$749 million or 15.8 percent above the FY10 enacted level. While the bulk of this increase is allotted for NOAA's environmental satellite programs, the budget request also includes the largest reorganization of NOAA since its inception in 1970.

NOAA Climate Service

The FY12 request creates a new line Climate Service line office, with a budget of \$346.2 million. Much of the funding for the new Climate Service will be taken through a transfer of existing resources from the following line offices: Oceanic and Atmospheric Research (OAR), the National Environmental Satellite Data Information Service (NESDIS), and the National Weather Service (NWS). The FY12 budget request for OAR is \$212 million, a decrease of \$237.1 million or 52.8 percent, which reflects a significant amount of climate research moved into the new Climate Service. The NWS Climate Prediction Center and some observation networks are also transferred to the Climate Service, but the overall FY12 budget request for NWS is reduced only \$11.8 million or 1.2 percent from the FY10 enacted level of \$999.8 million. NESDIS will shift all its data centers to the Climate Service, and the budget request reflects the change in priorities in this line office by changing its name to the National Environmental Satellite Service (NESS). The FY12 budget request for NESS is \$2 billion, an increase of \$620 million or 44.1 percent above the FY10 enacted level.

NOAA Polar Satellite Program

The substantial bump in the FY12 budget request for NESS is due to the Joint Polar Satellite System (formerly the National Polar-orbiting Operational Environmental Satellite System (NPOESS)). The increased funding will permit the agency to continue work on its first satellite for mid-afternoon orbit coverage under the program. The balance of the funds permit NOAA to complete and launch the NPOESS Preparatory Project (NPP) satellite, which will now bridge the gap between NOAA's current satellites and the new generation.

As part of a tri-agency effort with NASA and DOD, NOAA funded the development of NPOESS, which is the next generation of polar-orbiting weather satellites that serve both civilian and military weather forecasting and climatology needs. However, NPOESS suffered a series of cost increases (from \$6.9 billion at the program's outset to the Government Accountability Office's (GAO) last estimate of \$15 billion) and schedule delays (some five years for the first satellite launch) that now threaten the continuity of reliable high-quality weather and climate data. Reviews of NPOESS have blamed the cost and schedule overruns on the program's organizational structure, which places direction and decision-making authority with an Executive Committee consisting of the three agencies, rather than with a single agency. In the FY11 budget, the Administration split the program into two separate efforts. NOAA and NASA will be responsible for the satellites flying in "afternoon" orbits (i.e. passing over sunlit regions of the Earth at local afternoon), while DOD will take control of the spacecraft flying early morning orbits. The program will continue to rely on European satellites for coverage in a third, late-morning orbit.

Department of Homeland Security (DHS)***Department of Homeland Security (DHS) Spending***
(dollars in millions)

Account	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Enacted	
					\$	%
Science and Technology Directorate	830.1	1006.5	1018.3	1176.4	169.9	16.9
Domestic Nuclear Detection Office	484.4	383.0	305.8	331.7	(51.3)	(13.4)
Totals:	1314.5	1389.5	1324.1	1508.1	118.6	8.5

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. The Committee also has jurisdiction over fire and earthquake and nuclear detection programs at DHS.

Science and Technology Directorate

The FY12 budget request for DHS S&T is \$1.2 billion and would increase by \$170 million or 6.9 percent from FY10 enacted.

Most of this increase reflects the transfer of R&D programs from the DHS Domestic Nuclear Detection Office (DNDO) to DHS S&T. The balance of the \$170 million increase is focused on the Laboratory Facilities and Research, Development, and Innovation accounts. The facility funding increase will support the initial construction of the National Bio and Agro-Defense Facility (NBAF), the replacement for the Plum Island Animal Disease Center. The request also would fund an increase of \$18 million for the Comprehensive National Cybersecurity Initiative to support research and development projects focused on strengthening the Nation’s cybersecurity.

Accounts that are reduced in the FY12 DHS S&T request are Acquisition and Operations Support by 37 percent and University Programs (eliminating funding for the National Transportation Security Center of Excellence) by 26 percent.

Domestic Nuclear Detection Office

Within the DNDO, the FY12 request drops overall by \$118.6 million or 13.4 percent and includes a transfer of \$108.5 million from the Transformational Research and Development account to the S&T Directorate. This request was also proposed in FY11. The move of radiological and nuclear research from DNDO to S&T will consolidate all DHS basic research within S&T and increase the efficiency and effectiveness of the research.

Environmental Protection Agency (EPA)

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

Account	FY08 Actual	FY10 Enacted	FY11 Request	FY12 Request	FY12 Request versus FY10 Enacted	
					\$	%
Science and Technology	785.8	848.0	846.7	825.6	(22.4)	(2.6)
Office of Research and Development	*	596.7	605.7	584.1	(12.6)	(2.1)

*EPA is unable to determine this figure.

The Environmental Protection Agency (EPA) FY12 budget request for Science and Technology (S&T) programs is \$826 million, a decrease of \$22 million or 2.6 percent from the FY10 enacted

levels of \$848 million. 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 FY12 budget request of \$584.1 million is a decrease of \$12.6 million or 2.1 percent reduction from the FY10 enacted level of \$596.7. Although there is not a significant difference from the FY10 enacted level, the FY12 budget request reprioritizes research areas within EPA, and requests a \$24.7 million increase for the Science to Achieve Results (STAR) fellowship program. This increase is offset by reductions to Ecosystem Research and Homeland Security Research.

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

Good morning. We welcome today a hearing entitled “An Overview of the Administration’s Federal Research and Development Budget for Fiscal Year 2012.” In front of each of you I think are packets containing the written testimony, biography and the truth in testimony disclosure of today’s witness, Dr. John P. Holdren. I recognize myself for five minutes for an opening statement.

Dr. Holdren, I would like to welcome you to the Committee today. We all understand the influence the OSTP can have on the Administration’s direction in science and technology. Today’s hearing obviously covers a great deal of ground, so I will try to be brief. At the same time, there are some specific points that I would like to address before we hear from you.

Our debt today is slightly over \$14 trillion, and our Nation’s budget deficit has increased 50 percent over the last three years, and yet the amount of new debt proposed in this budget is greater than the total amount of debt accumulated by the Federal Government from 1789—and my children, I remember that date—to the day President Obama took the Oath of Office. This level of spending is simply not sustainable.

While it is true that prudent investments in science and technology will almost certainly yield future economic gains and will allow our knowledge and economy to grow, it is also true that these gains can be thwarted by poor decision-making. Americans expect and deserve better. With our unemployment hovering at nine 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.

In his State of the Union address, President Obama spoke of the need to reinvigorate our future through innovation. American ingenuity is going to determine our future. However, blanket increases in our federal spending are not the same as prudent investment 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. I recognize that the President is making similar statements, yet the Administration’s fiscal year 2012 R&D budget, at least as it pertains to a majority of the agencies within this Committee’s jurisdiction, continues a heavily weighted focus on climate change, oftentimes taking money from other worthy investments. This rather singular focus for the Federal Government’s limited research dollars slows our ability to make innovative and certainly it slows it down, other than revealing slows it 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 investing in remarkable research that seeks the improvement of the way we live our lives. Previous investments brought about the Internet, the laser, barcodes, MRIs and even sunscreen. 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 of dollars spent on climate change programs with an eye toward effectiveness. From 2006 to now, we have spent \$36 billion on climate change and what do we have to show for it? A lot of programs and pamphlets. We need to change that.

With regard to NASA, last year's Congress reauthorized the space agency and sent a strong signal to this Administration, which disturbingly, they have not followed in the area of human space exploration. For our space program to remain competitive and ensure our national security, we have to stay the course and develop the next-generation launch vehicle that has the capability to reach outer space and beyond. Our country cannot afford an ill-focused space program. I am concerned that the President's budget defies Congress' direction with respect to the exploration account and will have some questions for you with respect to that decision.

Dr. Holdren, we remain committed to assisting you as we move forward, but hope you will take the message back to the President that we continue to have significant concerns with the Administration's priorities for our Nation's precious and limited R&D dollars.

I thank you, and we look forward to your testimony.

[The prepared statement of Chairman Hall follows:]

PREPARED STATEMENT OF CHAIRMAN RALPH M. HALL

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Thank you, and we look forward to your testimony.

Chairman HALL. The Chair now recognizes Ranking Member Ms. Johnson for an opening statement.

Ms. JOHNSON. Thank you very much, Mr. Chairman, and welcome back to the committee, Dr. Holdren.

We are in a very unusual situation today. We are here today to discuss the President's fiscal year 2012 budget request, even as the fiscal year 2011 budget remains in play, so I hope we can keep the numbers and the years straight. However, even if we jump back and forth in terms of what year we are talking about, the key issues that we need to address remain the same: how best to keep America competitive and create a better future for our children and grandchildren.

With the C.R. the House is debating this week, I am afraid we are heading in the wrong direction and I am worried for our country and for our own grandchildren and what kind of opportunities they will have in the future. As we focus on the need to create jobs both now in the coming years, we need to make sure that we are taking steps to ensure that we remain economically strong and competitive in a challenging international marketplace. This committee has heard countless witnesses from industry, academia and government over the past several years testify that investments in science, technology and STEM education must be a cornerstone of any serious long-term strategy to keep America competitive. While we also need to address tax and other policies that affect innovation, none of those policies will be of any use if we don't first invest in human capital and the research that makes innovation possible.

Let me be clear: While we debate turning the lights off on groundbreaking research projects, shuttering the world-class research facilities, stopping emerging industries in their tracks and losing many of our best and brightest scientists and innovators from the STEM pipeline for good, our competitors in China, India and elsewhere are surging ahead in their investments in R&D and in emerging industries. They are going to eat our lunch. They are right now, as a matter of fact, and then our dinner and dessert too. Now is simply not the time to take a hatchet to federally funded R&D and STEM education.

Having said that, I still find reason to be hopeful that as we kick off today's hearing. Our federal R&D agencies have a long history of investing in research and education programs that return huge economic payoffs to the American people.

The fiscal year 2012 R&D budget proposal being presented to us today by Dr. Holdren reflects the imperative to invest in our future

and at the same time acknowledges the fiscal environment in which we find ourselves. Truthfully, I would like to see more, including for NASA, for information technology research and for programs that have demonstrated success in broadening the participation of women and underrepresented minorities in STEM. Instead, the budget proposes to hold many of those programs flat once again. However, I also understand that the President had to make some very tough decisions in developing this year's budget request. We can disagree over some of the specific choices but I believe, Dr. Holdren, that we share the same goals of maintaining a strong national science and technology enterprise and ensuring our young people are prepared for the technical careers of the future.

I look forward to learning more from you about the President's R&D budget proposal and to working with you and members from both sides of the aisle to forge a productive path ahead.

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

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF REPRESENTATIVE EDDIE BERNICE JOHNSON

Thank you Chairman Hall, and welcome back to the

Committee, Dr. Holdren. We are in a very unusual situation today. We are here today to discuss the president's fiscal year 2012 budget request even as the fiscal year 2011 budget remains in play. So I hope we can keep the numbers and years straight. However, even if we jump back and forth in terms of what year we are talking about, the key issues that we need to address remain the same, how best to keep America competitive and create a better future for our children and grandchildren.

With the CR the House is debating this week, I am afraid we are heading in the wrong direction. And I am worried for our country and for my own grandchildren and what kind of opportunities they will have in the future. As we focus on the need to create jobs both now and in the coming years, we need to make sure that we are taking the steps to ensure that we remain economically strong and competitive in a challenging international marketplace.

This Committee has heard countless witnesses from industry, academia, and government over the past several years testify that investments in science, technology and STEM education must be a cornerstone of any serious long-term strategy to keep America competitive.

While we also need to address tax and other policies that affect innovation, none of those policies will be of any use if we don't first invest in the human capital and the research that makes innovation possible.

Let me be clear--while we debate turning the lights off on groundbreaking research projects, shuttering world-class research facilities, stopping emerging industries in their tracks, and losing many of our best and brightest scientists and innovators from the STEM pipeline for good, our competitors in China, India and elsewhere are surging ahead in their investments in R&D and in emerging industries. They are going to eat our lunch, and then our dinner and dessert too. Now is simply not the time to take a hatchet to federally funded R&D and STEM education.

Having said that, I still find reason to be hopeful as we kick off today's hearing. Our federal R&D agencies have a long history of investing in research and education programs that return huge economic pay-offs to the American people. The fiscal year 2012 R&D budget proposal being presented to us today by Dr. Holdren reflects the imperative to invest in our future at the same it acknowledges the fiscal environment in which we find ourselves.

Truthfully I would like to see more, including for NASA, for information technology research, and for programs that have demonstrated success in broadening the participation of women and underrepresented minorities in STEM. Instead the budget proposes to hold many of those programs flat once again. However, I also understand that the President had to make some very tough decisions in developing this year's budget request.

We can disagree over some of the specific choices, but I believe, Dr. Holdren, that we share the same end goals of maintaining a strong national science and technology enterprise and ensuring our young people are prepared for the technical ca-

reers of the future. I look forward to learning more from you about the president's R&D budget proposal and to working with you and Members from both sides of the aisle to forge a productive path forward.

Chairman HALL. Thank you, Ms. Johnson.

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

At this time I will introduce—we will have the one witness and I will first thank you for our inability to begin as scheduled and hope we don't ruin the rest of your day here. Ms. Johnson says that is not what is going to ruin it. No matter what we say or do, we appreciate you, and if you really listen to us and obey us, why, we are really going to treat you good, and if you don't, we are going to treat you good, so there you go.

At this time I would like to introduce our witness, and I am proud to introduce Dr. John Holdren as 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 should know and does know, spoken testimony is limited to five minutes, after which the members of the Committee will have five minutes each to ask questions, but we are able, particularly on days like this, to provide flexibility to you since you are the only witness and you have been so very patient. I recognize you, sir.

**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. Thank you very much, Chairman Hall, Ranking Member Johnson, Members of the Committee. It is a real privilege for me to be here today to discuss with you the civilian science and technology components of the President's FY 2012 budget.

The premise behind this part of the budget is one that I believe we all share. It is that creating America's jobs and industries of the future, and indeed creating the quality of life that we all want for our children and grandchildren is going to require investing in the creativity and the capacity to innovate of the American people. The FY 2012 budget does so with responsible, targeted investments in the foundations of discovery and innovation, in R&D, in science, technology, engineering and math education, and 21st century infrastructure. It does it with increases in the highest-priority focuses offset by reductions in lower-priority ones. It is a budget aimed at helping us win the future by out-innovating, out-educating and out-building, the competition.

Obviously, we need the continued support of the Congress to get it done, and I stress continued support because strengthening the national effort in science, technology, and innovation has been very much a joint effort of the Congress and the Administration over the past two years. We hope to extend that partnership in this new Congress.

All told, this budget proposes \$66.8 billion for civilian research and development, an increase of \$4.1 billion, or 6 1/2 percent, over the 2010 appropriated level in this category. But the Administration is committed to reducing the deficit even as we prime the pump of discovery and innovation. Accordingly, our proposed investments in R&D, STEM education, and infrastructure fit within an overall non-security discretionary budget that would be frozen at 2010 levels for the second year in a row. The budget reflects strategic decisions to focus resources on those areas where the pay-off for the American people is likely to be highest.

Mr. Chairman, I know the Committee is already familiar with the details of the Administration's FY 2012 proposed budget. Let me therefore only very briefly highlight a few key points.

First of all, consistent with the America COMPETES Reauthorization Act, which was passed in December with leadership from this Committee and signed by the President in January, the budget calls for continuing along the doubling trajectory for the National Science Foundation, the Department of Energy's Office of Science, and the National Institute of Standards of Technology laboratories.

In the case of NASA, the President's budget holds that agency to the 2010 appropriated level of \$18.7 billion while still funding every initiative called for in the 2010 NASA Authorization Act. The President's budget also helps the National Oceanic and Atmospheric Administration improve critical weather and climate services, invest more heavily in restoring our oceans and coasts and ensure continuity in crucial Earth observation satellite coverage.

The budget reinforces the Department of Energy's work to make clean energy affordable and abundant with notable increases for ARPA-E, Energy Efficiency and Renewable Energy, and Electricity Delivery and Energy Reliability.

To help the Nation win the future, the 2012 budget also emphasizes STEM education, in part by providing \$100 million as a down payment on a ten-year effort to help prepare 100,000 new, highly effective STEM teachers.

Additionally, the budget includes investments for a Wireless Innovation and Infrastructure Initiative to help extend the next generation of wireless Internet to 98 percent of the United States population.

Let me reiterate in closing the guiding principal underlying this budget: America's strength, prosperity, and global leadership depend directly on the investments we are willing to make in R&D, in STEM education and in infrastructure. Investments in these domains are the ultimate act of hope, the source of the most important legacy that we can leave. Only by sustaining those investments can we assure future generations of Americans a society and a place in the world worthy of the history of this great Nation which has been building its prosperity and its global leadership on a foundation of science, technology, and innovation since the days of Jefferson and Franklin. Staying the course in the current fiscal environment will not be easy but I believe the President's 2012 budget for science and technology provides a blueprint for doing so that is both visionary and responsible. The support of this Committee, which has been the source itself of so much visionary and

also responsible legislation in this domain, will be essential if we are to stay the course.

I look forward to working with you to that end, and I will be pleased to try to answer any questions the members may have. Thank you for your attention.

[The prepared statement of Dr. Holdren follows:]

PREPARED STATEMENT OF JOHN P. HOLDREN

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) 2012 Budget.

Administration Initiatives in Education, Innovation, and Infrastructure

President Obama, in his most recent State of the Union address, called on all of us to help create the American jobs and industries of the future by doing what this Nation does best—investing in the creativity and imagination of the American people. The President identified this time in history as our generation's Sputnik moment. And just as investments in science and engineering research and development (R&D) turned the original Sputnik moment into a Golden Age of American technological and economic dominance, so new investments in science, technology, and innovation (STI) will be the foundation for continued American leadership in the future. Targeted investments in the most promising frontiers of science, made in the context of responsible reductions in less productive endeavors, will fuel this trajectory and allow us, in the President's words, to "out-innovate, out-educate, and out-build the rest of the world."

President Obama understands that our ability to meet the grand challenges before us is intimately dependent on robust research and development; superior science, technology, engineering, and mathematics (STEM) education; and 21st century transportation, telecommunications, and energy infrastructure. His 2012 Budget provides strategic investments in these domains while also streamlining aspects of the Federal government and responding responsibly to the deficit. At a difficult time in America's history, the President's 2012 Budget proposes to invest intelligently in innovation, education, and infrastructure today to generate the industries, jobs, 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 two years of the Administration. And with the start of this new Congress, we hope to extend this partnership with both the Senate and the House across the entire science and technology portfolio. Such a collaboration to stimulate scientific discovery and new technologies will take America into this new century well-equipped for the challenges and opportunities that lie ahead.

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

The Federal R&D Budget

In his State of the Union address, the President said: "The first step in winning the future is encouraging American innovation," and he promised to deliver a budget that would ensure the Nation's ability to achieve that goal. This week, the President released that budget. It proposes a record \$66.8 billion investment in civilian research and development, an increase of \$4.1 billion or 6.5 percent over the 2010 funding level, reflecting the Administration's firm belief that investment in civilian research is a key ingredient for cultivating the innovation that is so important to growing the American economy of the future.

(Because of the uncertainty around the outcome of 2011 appropriations, all the comparisons in my testimony are between the 2012 Budget and the enacted 2010 appropriations. My testimony discusses changes in current dollars, not adjusted for inflation. The latest economic projections show inflation of 2.7 percent between 2010 and 2012 for the economy as a whole, using the GDP deflator.)

These important R&D investments will bolster the fundamental understandings of matter, energy, and life that are at the root of much innovation, and they will foster significantly new and potentially transformative technologies in areas such as biotechnology, information technology, and clean energy.

The Obama Administration's investments in innovation, education, and infrastructure fit within an overall non-security discretionary budget that would be fro-

zen at 2010 levels for the second year in a row and would stay frozen to 2015. 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 2012 Budget proposes \$79.4 billion for development within the Federal R&D portfolio—a decline compared to the 2010 funding level primarily because of reductions in development funding in the Department of Defense. Across government, important programs will have to make do with less, as noted in several of the program descriptions below. The total (defense and nondefense) R&D budget would be \$147.9 billion, \$772 million or 0.5 percent above the 2010 enacted level. That modest increase is difficult to accept, of course, given the many needs that could potentially be addressed by an expanded Federal R&D portfolio. But the Administration is committed to making tough choices and it has made many such in this Budget.

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, the Administration's Innovation Strategy, and the America COMPETES Reauthorization Act, passed by the Congress in December through the leadership of this Committee and signed by the President in January. Those three jewel-in-the-crown agencies are the National Science Foundation, a primary source of funding for basic academic research; the Department of Energy's (DOE's) Office of Science, which leads fundamental research relevant to energy and also builds and operates the major research infrastructure—advanced light sources, accelerators, supercomputers, and facilities for making nano-materials—on which our scientists depend for energy research breakthroughs; and the National Institute of Standards and Technology laboratories, which support a wide range of pursuits from accelerating standards development for health information technology and “smart grid” technologies 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 these agencies on a doubling trajectory. The FY2012 budget maintains that trajectory, as newly authorized in the America COMPETES Reauthorization Act (Public Law 111-358), with a 12.2 percent increase between 2010 and 2012 for their combined budgets, totaling \$13.9 billion. I want to emphasize that the proposed increases for these three agencies are part of a fiscally responsible budget focused on deficit reduction that holds overall non-security discretionary spending flat at 2010 levels for the second year in a row, 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 believed 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 billion dollar, job-creating companies, the 2012 Budget request for NSF is \$7.8 billion, an increase of 13.0 percent above the 2010 funding level. This keeps NSF on track to double its budget as promised in the President's Plan for Science and Innovation.

NSF puts the greatest share of its resources in the nation's colleges and universities. Universities are the largest performers of basic research in the United States, conducting over fifty 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 2012 Budget sustains the doubling of new NSF Graduate Research Fellow-

ships to support 2,000 new awards. The 2012 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; ATE is the centerpiece of an overall \$100 million NSF investment in community colleges, an important part of the higher education system.

NSF also proposes to increase research funding to promote discoveries that can spark innovations for tomorrow's clean energy sources with a cross-disciplinary approach to sustainability science. The Science, Engineering, and Education for Sustainability (SEES) portfolio will increase to \$998 million in the 2012 Budget for integrated activities involving energy and environment. NSF is also committed to enhancing U.S. economic competitiveness with Science and Engineering Beyond Moore's Law (SEBML), a multidisciplinary research program that aims to extend the technological and conceptual limits on computer processing, with an investment of \$96 million in the 2012 Budget. NSF is also investing \$76 million in a multi-directorate initiative on research at the interface of the Biological, Mathematical, and Physical Sciences (BioMaPS) that aims for an accelerated understanding of biological systems and the opening of new frontiers in biotechnology. The Administration proposes \$15 million in the 2012 Budget for NSF's contribution to a new interagency initiative called Enhancing Access to the Radio Spectrum, or EARS, to support research into new and innovative ways to use the radio spectrum more efficiently so that more applications and services used by individuals and businesses can occupy the limited amount of available spectrum.

National Aeronautics and Space Administration (NASA)

This past October, the President signed the 2010 NASA Authorization Act (the "Act", Public Law 111-267), which stands as a statement of bipartisan agreement by Congress and the Administration regarding NASA and its many programs. NASA's programs not only support the grand and inspiring adventures of space exploration, scientific discovery, and aeronautical advancement, but also provide an indispensable platform for observing the Earth to ensure that we have the information we need to cope with weather-related and other environmental threats to human well-being. NASA programs also fuel new technology development and innovation and help launch new products, services, businesses, and jobs with enormous growth potential. The Act will further our joint goal of placing NASA's programs on a more stable footing and enhancing the long-term sustainability of these exciting endeavors as we chart a new path forward in space.

The FY2012 NASA budget reaffirms the Administration's commitment to a bold and ambitious future for NASA. Every initiative called for in the Act is funded, including: a robust program of space science and Earth science, including a commitment to invest in new satellites and programs of Earth observation; a strong aeronautics research program; the Space Launch System (SLS) heavy-lift launch vehicle and Multi-Purpose Crew Vehicle (MPCV) needed to support human spaceflight and exploration missions beyond Earth's orbit; a vigorous technology development program; extension of International Space Station (ISS) activities through at least 2020, coupled with a plan to use this orbiting outpost more effectively; and the development of private-sector capabilities to transport cargo and crew into low Earth orbit, thus shortening the duration of our reliance solely on Russian launch vehicles for access to the ISS.

Within the context of a difficult budget environment and the President's decision to freeze non-security discretionary spending at 2010 levels for five years, NASA's budget remains at \$18.7 billion in the 2012 Budget. This budget level demands difficult choices, and those choices were made while keeping in mind the priorities of the Act as well as the collective desire of the Congress and the Administration to have a balanced program of science, research, technology development, safe spaceflight operations, and exploration. One such difficult choice was limiting the budget for the James Webb Space Telescope, keeping the project funded at \$375 million in 2012, to assure NASA the opportunity to begin work on new scientific opportunities identified in the National Academies' most recent decadal survey in astronomy and astrophysics. Similarly, the 2012 Budget reduces the planned increases in Earth-science research outlined in the 2011 Budget. The Budget demonstrates the President's continued commitment to our shared priorities even when difficult decisions are required, providing \$1.8 billion in FY2012 funding for the Space Launch System and \$1.02 billion for the Multi-Purpose Crew Vehicle, thereby laying the critical foundation for these exploration programs. As NASA reported in January of this year, it is still in the process of shaping these efforts and will discuss them in more detail in a report to Congress this spring. Similarly, the Budget provides a solid foundation for the commercial crew and cargo transportation programs that

are necessary to provide safe and cost-effective access to low Earth orbit, including sufficient support for the operations of 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, helping ensure that America remains the world leader in measurement innovation and systems interoperability. Reflecting NIST's vital role in supporting the economy and infrastructure, the 2012 Budget of \$764 million for the Institute's intramural laboratories amounts to a 15.1 percent increase over the 2010 enacted level. That increase will support high-performance laboratory research and facilities for a diverse portfolio of investigations in areas germane to advanced manufacturing, health information technology, cybersecurity, interoperable smart grid, and clean energy. For NIST's extramural programs, the 2012 Budget requests \$143 million for the Hollings Manufacturing Extension Partnership (MEP), an \$18 million increase over the 2010 enacted level. The 2012 Budget also requests \$75 million for the Technology Innovation Program (TIP), a \$5 million increase over 2010, and \$12 million for the Advanced Manufacturing Technology Consortia program, a new public-private partnership that will develop road maps for research that will broadly benefit the Nation's industrial base. All of these NIST programs are important components of *A Framework for American Manufacturing*, a comprehensive strategy for supporting American manufacturers announced in December 2009, and the Administration's revised Innovation Strategy 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. The NOAA budget of \$5.5 billion is an increase of \$749 million over the 2010 enacted level. This will allow NOAA to strengthen the scientific basis for consequential environmental decision-making, improve critical weather and climate services that protect life and property, invest more heavily in restoring our oceans and coasts, take advantage of high-performance computing to manage weather and climate data, and ensure continuity in crucial Earth-observation satellite coverage. The 2012 Budget proposes a restructuring of NOAA, including the creation of a Climate Service line office in NOAA that will focus on the delivery of climate services while sustaining research on oceans, atmosphere, and climate.

NOAA satellite systems are critical for our Nation's ability to forecast severe weather, such as blizzards or hurricanes, and as such can save lives and property. Ensuring that we retain these capabilities remains a top priority in the 2012 Budget. The former National Polar-orbiting Operational Environmental Satellite System (NPOESS) program had a troubled history, as illustrated by numerous Congressional hearings and GAO reports. Because of this, in early 2010 the Administration announced a significant restructuring of the program, and this plan was endorsed by Congress as part of the 2010 NASA Authorization Act (Section 727). This restructuring was accompanied by significant increases in NOAA's 2011 Budget request in order to expedite the launch schedule of these essential weather satellites and reduce the risks of a gap in forecasting data. However, because the current continuing resolution allows for only a fraction of the funding necessary in FY2011 to continue work on the instruments and spacecraft for the first of NOAA's satellites (the first Joint Polar Satellite System mission, or JPSS-1), work on the first JPSS satellite has been slowed down considerably. Under current funding scenarios, the JPSS-1 mission could be delayed by up to two years, thus forcing the weather forecasting community to rely solely on satellites that will be operating well past their planned mission life. The 2012 Budget request provides \$1.1 billion to continue the development of the Joint Polar Satellite System, a significant increase over the 2010 enacted level which reflects the need for NOAA to fully fund the acquisition of satellites for the afternoon orbit within its own budget. NOAA recognizes the magnitude of the requested investment for environmental operational satellites. However, given the impact of weather on society and the nation's economy, the ability to warn and protect our citizens from harm is well worth the cost.

Department of Energy (DOE)

The Administration is directing Federal innovation incentives to one of the most important, job-creating, innovation-inspiring challenges of our time: making clean energy affordable and abundant. The DOE R&D portfolio is a key part of this effort, which is why DOE R&D increases to \$13.0 billion in the 2012 Budget. This rep-

resents targeted growth of 19.9 percent and does not include DOE's non-R&D clean-up, weapons, and energy-deployment programs. The 2012 Budget also proposes significant resources for demonstration and deployment incentives as part of a comprehensive framework for moving the United States toward a clean-energy future. 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 of having 1 million electric vehicles on the road by 2015. To help pay for these priorities, we are proposing to cut inefficient subsidies that we currently provide, unnecessarily, for fossil fuels.

The 2012 Budget proposes \$550 million in appropriations for the Advanced Research Projects Agency–Energy, or ARPA–E, and another \$100 million in mandatory funding under the Wireless Innovation Fund. The Budget will advance ARPA–E's portfolio of transformational energy research with real-world applications across 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, which was recently reauthorized.

The 2012 Budget also doubles the number of Energy Innovation Hubs to solve key challenges that require cross-cutting inputs from diverse disciplines. The three new Hubs will focus on Batteries and Energy Storage, Smart Grid Technology and Systems, and Critical Materials. Two weeks ago, the President visited the existing Energy Efficient Building System Design Hub, which will accelerate the development of innovative designs for cost-effective lighting, sunlight-responsive windows, and smart, thermodynamic heating and cooling systems, which together will help make America home to the most energy-efficient buildings in the world. The other two existing Hubs focus on Fuels from Sunlight and Modeling and Simulation for Nuclear Reactors.

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 economically significant domains such as nanotechnology, advanced materials, high-end computing, energy supply and end-use efficiency, and climate change. The 2012 Budget of \$5.4 billion, more than 10 percent above the 2010 enacted level, increases funding for facilities and cutting-edge research geared toward addressing fundamental challenges in many areas including clean energy and climate change, as well as multi-scale carbon cycle research to underpin measurement, reporting, and verification of greenhouse gas emissions.

Investments in DOE's clean-energy applied R&D programs target gains over the next several decades for reducing dependence on oil and accelerating the transition to a low-carbon economy. The President's 2012 Budget increases investments in Energy Efficiency and Renewable Energy by more than 40 percent over the 2010 appropriation to a total of \$3.2 billion. EERE supports important work in industrial productivity, R&D on advanced batteries for electric and hybrid vehicles, and building technology R&D to cut energy consumption. It also supports new deployment activities in these areas, including a \$200 million competitive grant program to encourage electric vehicle (EV) readiness and a \$100 million competitive "Race to Green" program to encourage state and local governments to streamline codes, regulations, and performance standards and make efficient building the norm. Strong support continues for carbon capture and storage options that can significantly reduce the cost of transitioning to a low-carbon economy. The Budget also increases investments by more than 40 percent over 2010 funding levels in R&D to modernize the electric grid, critical to enabling clean energy sources, by providing \$238 million for Electricity Delivery and Energy Reliability.

To help pay for these programs and align policies toward new clean energy technologies, the Budget proposes to repeal over \$4 billion per year in inefficient fossil fuel subsidies. The Administration will continue to work in a bipartisan fashion to put in place market-based incentives to promote U.S. leadership in the clean-energy marketplace. Consistent with Administration policy to phase out inefficient fossil fuel subsidies, the Budget eliminates funding for R&D focused on increasing hydrocarbon production.

Environmental Protection Agency (EPA)

The R&D portfolio of the Environmental Protection Agency (EPA) is \$584 million in the 2012 Budget, a decline of \$13 million or 2.2 percent compared to the 2010 funding level. With this investment, EPA will focus on enhancing and strengthening the planning and delivery of science by restructuring its research and science programs to be more integrated and cross-disciplinary. This request supports high-priority research of national importance in such areas as endocrine disrupting chemi-

cals, green chemistry, e-waste and e-design, green infrastructure, computational toxicology, air monitoring, drinking water, and STEM fellowships. In addition, by way of strategic redirections, EPA will significantly increase—by \$25 million—its outreach to the broader scientific community through its Science to Achieve Results (STAR) program. This investment will bring innovative and sustainable solutions to 21st century environmental science challenges by engaging the academic research community.

United States Geological Survey (USGS)

The total 2012 budget of the United States Geological Survey (USGS), Interior's lead science agency, is \$1.1 billion or a \$6 million increase from the 2010 enacted level. The Budget includes a total of \$126 million in program increases, offsetting a total of \$120 million in program reductions and savings, reflecting shifting priorities towards climate variability research and ecosystem restoration. There are significant decreases in minerals and water resources research as well as targeted increases, including \$11 million to complete the network of climate science centers that will develop research-based decision support tools for use by Federal land managers. The 2012 Budget also proposes an addition of \$60 million over the 2010 level for Landsat operations and the development of a new operational Landsat satellite program, which will continue to collect remote sensing data that are invaluable for many purposes, including climate and land-use change research.

Department of Homeland Security (DHS)

Department of Homeland Security (DHS) R&D totals \$1.1 billion in the 2012 Budget, up \$167 million or 18.8 percent from the 2010 enacted level. Within the DHS Science and Technology Directorate, the 2012 Budget proposes \$150 million to begin construction of the National Bio and Agro-defense Facility (NBAF), which will serve as a new, state-of-the-art biosafety level 3&4 facility for the development of vaccines and anti-virals and enhanced diagnostic capabilities for protecting the United States against emerging agricultural diseases. The Budget also proposes \$64 million for research to support the Comprehensive National Cybersecurity Initiative (CNCI), an increase of \$22 million from the 2010 enacted level.

Department of Transportation (DOT)

The 2012 Budget provides \$1.2 billion for Department of Transportation (DOT) R&D, an increase compared to the 2010 funding level. One significant part of DOT's R&D activities is the Federal Aviation Administration's (FAA) Research, Engineering, and Development program. The Budget includes funding for several R&D activities in FAA's Next Generation Air Transportation System, known as NextGen. The Joint Planning and Development Office coordinates this important effort with NASA and other participating agencies. 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 2012 Budget requests \$6.65 million for White House Office of Science and Technology Policy (OSTP) operations, 5 percent below the 2010 enacted funding level, in recognition of the need for shared sacrifice to freeze non-security discretionary spending. OSTP works with OMB to ensure that the President's S&T priorities are appropriately reflected in the budgets of 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 interagency research initiatives through administration of the National Science and Technology Council (NSTC), serves as the lead White House office in a range of bilateral and multilateral S&T activities internationally, and provides administrative and technical support for the very active 21-member President's Council of Advisers on Science and Technology (PCAST). This work is accomplished with approximately 34 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 function. In addition, there are approximately

40 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 all available resources to ensure that the science and technology work of the Federal government is appropriately resourced, coordinated and leveraged.

Interagency Initiatives

A number of priority interagency S&T initiatives are highlighted in the President's 2012 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) program plans and coordinates agency research efforts in cyber security, high-end computing systems, advanced networking, software development, high-confidence systems, information management, and other information technologies. The 2012 Budget provides \$3.9 billion for NITRD, an increase of \$74 million over the 2010 funding level.

Networking and computing capabilities are more critical than ever for a range of national priorities, including national and homeland security, reforming the health care system, understanding and responding to environmental stresses, increasing energy efficiencies 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 2012 Budget includes a focus on research to improve our ability to derive scientific insights and economic value from enormous quantities of data that heretofore would have been too large to take full advantage of, 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.

National Nanotechnology Initiative

The 2012 Budget provides \$2.1 billion for the multi-agency National Nanotechnology Initiative (NNI), an increase of \$201 million over the 2010 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. 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. In 2012, NNI agencies will be moving forward, using close and targeted program-level interagency collaboration, on three signature initiatives in areas ready for advances: Nanoelectronics for 2020 and Beyond; Sustainable Manufacturing—Creating the Industries of the Future; and Nanotechnology for Solar Energy Collection and Conversion.

In addition, agencies continue to maintain a focus on developing nanotechnology responsibly with attention to potential human and environmental health impacts, as well as ethical, legal, and other societal issues. I will also add that within weeks, I will be submitting to the Committee a revised strategic plan for the NNI reflecting the changing opportunities for frontier research at the nanoscale.

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 2012 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 2012 Budget provides \$2.6 billion for the multi-agency U.S. Global Change Research Program (USGCRP)—an increase of 20.3 percent or \$446 million over the 2010 enacted level—to continue its important work of improving our ability to understand, predict, project, mitigate, and adapt to climate change.

As you are no doubt aware, 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 funding plans to ensure the program is aligned with the Administration's priorities and reflects agency planning. In 2011, the USGCRP is undertaking a comprehensive process that will result in an updated strategic plan, which will be submitted to Congress later this year.

Funding in the 2012 Budget will support an integrated and continuing National Climate Assessment of climate change science, impacts, vulnerabilities, and response strategies as mandated by Congress. The Budget also prioritizes an inter-agency research effort for measuring, reporting, and verifying greenhouse-gas emissions.

Innovation, Entrepreneurship, and Job Creation

The President believes we must harness the power and potential of science, technology, and innovation to transform the Nation's economy and to improve the lives of all Americans. In addition to the investments in research and development (R&D) I have described, the President's 2012 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. Earlier this month, the President released a revised Strategy for American Innovation, building on an earlier version released in September 2009. This strategy describes how investments in R&D work together with other Federal investments and policies to support American innovation. Let me share with you a few highlights that are reflected in the Budget.

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. In December, the President and Congress worked together to extend expiring tax breaks for Americans; as part of that agreement, the current R&E tax credit was extended through the end of this year. The 2012 Budget proposes to expand and simplify the credit as part of making it permanent.

In addition, two weeks ago the Administration announced Startup America, a campaign to inspire and accelerate high-growth entrepreneurship throughout the Nation. This coordinated public/private effort brings together an alliance of the country's most innovative entrepreneurs, corporations, universities, foundations, and other leaders, working in concert with a wide range of Federal agencies to increase the prevalence and success of American entrepreneurs. A broad set of Federal agencies will launch a coordinated series of policies that ensure high-growth startups have unimpeded access to capital, expanded access to quality mentorship, an improved regulatory environment, and a rapid path to commercialization of federally-funded research.

The 2012 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 recently in the America COMPETES Reauthorization Act. And as mentioned earlier, the 2012 Budget continues to increase funding for 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. Taken together, these investments will help ensure that Federal investments in innovation, education, and infrastructure translate into commercial activity, real products, and jobs.

Science, Technology, Engineering, and Mathematics (STEM) Education

In his State of the Union address, the President said: "If we want innovation to produce jobs in America and not overseas, then we also have to win the race to educate our kids." To help win that race, the 2012 Budget emphasizes science, technology, engineering, and mathematics (STEM) education, building on two strong years of progress. Through his past budget requests and actions—including his recent hosting of the first White House science fair, his launch of the "Educate to Innovate" and "Change the Equation" initiatives, and his challenging the Nation's 200,000 Federal scientists and engineers to get more involved in STEM education—the President has shown that he is deeply committed to improving STEM education.

These efforts have engaged not only the Federal government but also the private, philanthropic, and academic sectors. The Educate to Innovate campaign has resulted in over \$700 million in financial and in-kind private-sector support for STEM education programs. And the Change the Equation program has brought together over 100 corporations in a historic effort to scale up effective models for improving STEM education. The Administration has also integrated STEM education into broader education programs. For example, the Race to the Top competition provided a competitive advantage to states that committed to a comprehensive strategy to improve STEM education.

Building on these efforts, the 2012 Budget proposes an investment of \$100 million as a down payment on a 10-year effort to help prepare 100,000 new highly effective STEM teachers. This coordinated effort between NSF and the Department of Education will help prepare teachers with both strong teaching skills and deep content knowledge. The Administration proposes \$80 million for the Department of Education in the 2012 Budget to expand promising and effective models of teacher STEM preparation within the new Teacher and Leader Pathways program—for example, ones that provide undergraduates with early and intensive field experience in the classroom along with extensive STEM subject coverage. At the same time, NSF proposes to launch a \$20 million teacher-education research program called Teacher Learning for the Future. In cooperation with the Department of Education, this NSF program will fund research that will increase our understanding of what makes a great STEM teacher and how to best prepare, support, and retain highly effective STEM teachers in the most cost effective manner. The coordination of these two programs will ensure that there is continual innovation and improvement in teacher preparation that is grounded firmly in evidence.

This is 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, in coming weeks I will establish a Committee on STEM Education under the National Science and Technology Council. The STEM Education Committee will be co-chaired by OSTP's Associate Director for Science, Carl Wieman, a Nobel Prize-winning physicist renowned for his work on improving STEM education, and will involve participation from the many Federal agencies involved in STEM education activities.

The work of this Committee will be closely aligned with the vision for STEM education outlined by Congress in the America COMPETES Reauthorization Act and will focus on improving the coordination and effectiveness of all Federal STEM education programs. In this spirit, the Department of Education and NSF are leading an effort, with active OSTP participation, to increase the impact of the Federal STEM investments I've outlined above by (1) developing an aligned strategy that emphasizes key agency capacities; (2) clarifying evidence standards used to assess program impact; and (3) identifying the most promising STEM efforts for further validation, testing, and suitability for scaling up.

All told, the 2012 Budget requests \$3.4 billion for STEM education programs across the Federal government. This is \$200 million lower than the 2010 funding level and reflects some difficult choices. However, we feel this budget is better focused on programs that will make an impact.

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

21st Century Infrastructure

I've talked about innovation and education, and now I would like to talk briefly about the third step in winning the future: rebuilding America. 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 2012 Budget in investments that will not only rebuild the roads and bridges of the 20th century but will also help build the new infrastructure needed for America to remain competitive in this century.

Within science and technology, the 2012 Budget proposes a Wireless Innovation and Infrastructure Initiative to help businesses extend the next generation of wireless coverage to 98 percent of the U.S. population. This Initiative 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. It will also foster the conditions for the next generation of wireless technology, nearly doubling the amount of wireless spectrum for mobile broadband and providing critical support for R&D in wireless innovation. The Initiative builds upon the Presidential Memorandum on spectrum released last year, which proposes to reallocate a total of 500 megahertz of Federal agency and commercial spectrum bands over the next ten years to increase the Nation's access to wireless broadband.

As part of the Initiative, the 2012 Budget proposes the creation of a \$3 billion Wireless Innovation (WIN) Fund to be funded out of receipts generated through electromagnetic-spectrum auctions. This Fund will advance our economic growth and competitiveness goals, supporting key technological developments that will enable and take advantage of the private sector's rollout of next-generation wireless services and pave the way for new technologies. The WIN Fund will support basic research, experimentation and testbeds, and applied development in a number of areas including public safety, education, energy, health, transportation, and economic development.

The 2012 Budget also proposes investments in novel, game-changing physical infrastructure systems including a national high-speed rail system, an improved civil aviation system taking advantage of the NextGen air-traffic-control innovations, and new standards for smart-grid technologies.

Conclusion

The investments in research and development, innovation, STEM education, and 21st century infrastructure proposed in the President's FY2012 Budget reflect his 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 President has made difficult 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. Indeed, the science and technology investments in the 2012 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 science and in space.

As this Committee has long understood over the decades, 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 with unimagined benefits for our society. The truth is that this country's overall prosperity in the last half-century is due in no small measure to America's "innovation system"—a three-way partnership among academia, industry, and government.

One of President Obama's guiding principles is that America's present and future strength, prosperity, and global preeminence depend directly on fundamental research. Knowledge drives innovation, innovation drives productivity, and productivity drives America's economic growth. And so it logically follows that economic growth is a prerequisite for opportunity, and scientific research is a prerequisite for growth.

That is why President Obama believes that leadership across the frontiers of scientific knowledge is not merely a cultural tradition of our nation—today it is an economic and national security imperative. This Administration will ensure that America remains at the epicenter of the ongoing revolution in scientific research and technological innovation that generates new knowledge, creates new jobs, and builds new industries.

By sustaining our investments in fundamental research, we can ensure that America remains at the forefront of scientific capability, thereby enhancing our ability to shape and improve our Nation's future and that of the world around us.

I look forward to working with this Committee to make the vision of the President's FY2012 Budget proposal a reality. I will be pleased to answer any questions the Members may have.

BIOGRAPHY FOR JOHN P. HOLDREN

DR. JOHN P. HOLDREN is Assistant to the President for Science and Technology, Co-Chair of the Presidents Council of Advisors on Science and Technology (PCAST), and Director of the Office of Science and Technology Policy in the Executive Office of the President of the United States. Prior to joining the Obama Administration, he was the Teresa and John Heinz Professor of Environmental Policy and Director of the Program on Science, Technology, and Public Policy at the Kennedy School of Government, as well as a professor in the Department of Earth and Planetary Sciences, at Harvard University. Concurrently, from 2002, he served as co-chair of the independent, bipartisan National Commission on Energy Policy; from 2005, as the Director of the Woods Hole Research Center; and, from 2008, as Guest Professor in the School of Public Policy and Management at Tsinghua University, Beijing, China.

Dr. Holdren holds degrees in aerospace engineering and theoretical plasma physics from MIT (SB 1965, SM 1966) and Stanford (PhD 1970) and is the author of some 350 publications on global environmental change, energy technology and policy, nuclear arms control and nonproliferation, and science and technology policy. He is a member of the National Academy of Sciences, the National Academy of Engineering, the American Academy of Arts and Sciences, and the Council on Foreign Relations, as well as a foreign member of the Royal Society of London. He is also a former President of the American Association for the Advancement of Science; former Chairman of the Federation of American Scientists; and one of the first recipients, in 1981, of a MacArthur Foundation Prize Fellowship. In 1995 he gave the Nobel Peace Prize acceptance lecture on behalf of the Pugwash Conferences on Science and World Affairs, an international arms-control and scientific-cooperation organization in which he held leadership positions from 1982 to 1997.

From 1994 to 2001, Dr. Holdren served as a member of President Clinton's PCAST; from 1994 through 2004 he chaired the Committee on International Security and Arms Control of the National Academy of Sciences; and from 1991 to 2005 he was a member of the Board of Directors of the John D. and Catherine T. MacArthur Foundation. Early in his career he held positions at the Lockheed Missiles and Space Company, the Lawrence Livermore National Laboratory, and the Environmental Quality Laboratory and Division of Humanities and Social Sciences at the California Institute of Technology. From 1973 until 1996 he was the founding core faculty member and co-leader of the campus-wide, interdisciplinary, graduate-degree-granting Energy and Resources Group at the University of California, Berkeley.

Among other distinctions, he has been the recipient of the Volvo International Environment Prize, the Kaul Foundation Prize for Excellence in Science, the Tyler Global Environment Prize, and the Heinz Prize in Public Policy. He holds three honorary doctorates.

Holdren has been married for 44 years to Dr. Cheryl E. Holdren, a biologist; they have two grown children and five grandchildren ages 5 to 19. He was born in Sewickley, Pennsylvania, and grew up in San Mateo, California, attending public schools there.

Chairman HALL. Thank you, Dr. Holdren. I will recognize myself for the first five minutes and I will try to stay within the five minutes.

EPA announced the endangerment findings on December 7, 2009, at the beginning of the Copenhagen Climate Change Conference. I am sure you remember that, don't you, Doctor?

Dr. HOLDREN. Yes.

Chairman HALL. And I understand you as well as President Obama and other officials also attended. That finding was, so far as I know and believe, was the first time EPA had made a stand-alone declaration of a pollutant in advance of proposed regulations. I think that is true. Do you agree with that?

Dr. HOLDREN. I am not sure, Mr. Chairman.

Chairman HALL. Well, maybe I can help you. Maybe I can be of some benefit to you.

And it is curious that the announcement was made during the Copenhagen Conference and touted there by Administration officials presumably to give the Administration more leverage in the international negotiations. What was your role in the endangerment finding discussions and decisions, particularly with respect to the timing of it?

Dr. HOLDREN. Mr. Chairman, I did not have a role in the endangerment decision at all either in the internal deliberations at the EPA that led to reaching it or in the timing of the decision. That was not my domain.

Chairman HALL. Who made that decision?

Dr. HOLDREN. I assume the decision on the timing of the finding was that of the EPA Administrator, Lisa Jackson. I don't have any knowledge to the contrary.

Chairman HALL. Okay. Then let me move on. The Administration has told us time and again of the calamities of climate change, and you know there are some differences of opinion there, and we have been told that it was based on bad science. We don't know who told us that but we are going to try to have them before us to ask them who told them that and then try to have them before us because if it is based on bad science, people are entitled to know it. If it is not based on bad science, people are entitled to know it. We are really just going to seek the truth, and I don't think anybody ought to object to that search because we are sure going to make it.

In a recent interview, you had stated that Republicans needed to be educated on this issue. Maybe that was just something that our speechwriter put in there when they were mad at us like we say things to you that we try to impress upon you because you are in such a position to do so much for the states and the country and for the man that you report to. In recent interviews, you stated that we needed to be educated on the issue. I have to take issue with you on that a little bit. In August 2006, you knew I was going to ask you about the interview you had with BBC News, didn't you? You reportedly said that if the current pace of change continued, a catastrophic sea-level rise of 4 meters—that is 13 feet—was within the realm of possibility. While you were giving the interview, how sure were you about your prediction? As you know, the very next year the so-called gold standard of scientific consensus by global warming advocates projected that the oceans would rise between 7 and 23 inches, not 13 feet but less than 2 feet, between now and the year 2100. Let me ask you this: how sure was the scientific community of their prediction, in your opinion?

Dr. HOLDREN. Well, there are actually a number of questions there but let me start with the most recent, the one of sea-level rise. At the time there had been two referenced peer-reviewed publications in the scientific literature that pointed out that twice in the last 19,000 years the rate of sea level went up as much as 3 to 5 meters per century under forcings, that is, influences, on the climate, natural ones in this case, that were in the same range or smaller than the forces that are now being imposed on the climate, we believe mainly by human activity. At that time, therefore, the view that a sea-level rise of as much as four meters, which was in the middle of the range of 3 to 5, was a reasonable statement based on what was in the peer-reviewed literature. Subsequently, newer analyses have reduced that figure somewhat but the upper end of the range remains in the domain of 1 to 2 meters over the century we are now in at worst.

When the Intergovernmental Panel on Climate Change arrived at the estimate which you quoted, Mr. Chairman, they explicitly excluded, and they said so in a footnote, the dynamic processes which led in the past to these more rapid increases in sea level and they said they were leaving those out because they didn't believe that the scientific basis for modeling them quantitatively was yet adequate to support a particular number. Since that time—that

was the 2007 report of the IPCC, whose scientific inputs were finalized in December 2005. Since that time, there have been extensive new analyses which have supported the proposition that the sea-level rise in this century could be in the range of 1 to as much as even 2 meters. That is not a particular prediction. The range of uncertainty is large. But even half a meter would be an extremely consequential matter for people and businesses with oceanfront property.

Chairman HALL. There were a number of so-called scientific consensus statements, yours among several others, and some to the effect that the science is not good, not based on good science. I know you have heard that. I have heard it. I want to know who said it, who told them that, and what their background was.

Your projection of potential sea-level rise was over 11 feet higher than even the worst-case scenario projected by your colleagues less than a year ago so there is more than just a few of us Republicans that need to be educated on the issue. Given the disparity of these projections, why should the American taxpayer have confidence in the Administration's assurance of the global calamities to come or trust your climate change education campaign? That ought to roll you one that you might knock out of the park.

Dr. HOLDREN. Well, let me say first of all, Mr. Chairman, I want to clarify that in the interview you mentioned, I was not asked about Republicans as a whole, I was asked what do you plan to do in relation to those Members of Congress who believe that climate change is not a fact, is not real, and I said in relation to that particular question that I thought this was a matter of education because the scientific facts on the reality of climate change are very robust indeed.

Every major national academy of sciences in the world and virtually all of the major professional societies that deal with the relevant disciplines have issued statements saying that the evidence for climate change outside the realm of natural variability is overwhelming, that we have very strong reason to believe that human activity is responsible for a large part of this change, that harm is already occurring from these changes, and that the harm will grow unless and until we stabilize and begin to reduce our emissions. This is not the view of a few isolated scientists. This is the overwhelming view of scientists who study this matter around the world.

You will be able to produce on the witness stand a few who will say they don't believe it but they are very much in the minority. You could also produce people on this witness stand who will say, with Ph.D.'s attached to their name, that they don't believe cigarette smoking increases the risk of lung cancer. There are always skeptics, there are always heretics. That is in the nature of science. But public policy, in my judgment, should be based on the mainstream view because to base it otherwise is to risk the well-being of the public against very long odds.

Chairman HALL. Well, up to this time and for the past two years, say we have six or eight to testify such as you are testifying, so-called experts, five or six of them believed it was good science, maybe two of them—and we had no choice on who to bring. We

now have a choice and we asked for you first, and I thank you for your kindness.

Dr. HOLDREN. I am happy to be here.

Chairman HALL. My time is expired. I recognize Ms. Johnson. Ms. Johnson, you have five minutes, and I used about eight, so I will pay you back.

Ms. JOHNSON. Okay. Thank you very much.

Dr. Holdren, I have looked at the President's budget, and though I am disappointed, it does look better than what we are dealing with here now, but I did notice that the proposed STEM programs have been cut some, and I also would like to speak a bit about the coordination of the various programs between the Department of Education as it relates to STEM. I know there has been some major effort to coordinate. Give me a little update of where you are and how you think we are better utilizing the money.

Dr. HOLDREN. Well, Ranking Member Johnson, let me start by saying we are doing a lot of work to coordinate the efforts in education across the different federal agencies that have activities in this domain. I and OSTP, Melody Barnes, who chairs the Domestic Policy Council and has wider responsibilities for education in the White House, and Education Secretary Arne Duncan, all work very closely together on this to coordinate these activities and we work as well with the Department of Energy, with NASA, with the National Science Foundation and with other agencies. Even the Department of Defense has activities related to STEM education. We work with them as well. We think we have succeeded in bringing the parties together, focusing on the magnitude of the challenge, figuring out how to use our resources in complementary ways across those different agencies. This has led to identification of some savings that are reflected in the budget.

I would also say, though, in relation to the budget, and in particular the NSF part of the budget, that a great deal of the STEM education activity in the National Science Foundation actually goes in the various research directorates as a part of their activities without the word "education" appearing in the budget line because in the research directorates a great many of the grant programs actually require that educational activities be part of the activity of the researchers who receive the grant, and those kinds of activity have been increasing and we believe they are very effective.

Ms. JOHNSON. Now, just looking at the Continuing Resolution, there are really very deep cuts toward the hispanic-serving institutions like 78 percent, a third of the historically black colleges and a third or more of the tribal colleges. But what really gets my attention as well is that \$1 billion was cut from Head Start, and which means then it makes it more difficult to implement STEM courses because most of the kids that really need this orientation by a greater percentage—all of them need it but by a greater percentage—are Head Start-eligible children, and I wonder what kind of review has been given to these potential cuts? And I ask that because our U.S. companies or CEOs that we have had before this Committee have said that if we don't focus on the skilled labor and better education, that our companies would leave this country, and we are already behind now so I am wondering how do we move for-

ward to try to maintain some competitive edge with all of these potential cuts?

Dr. HOLDREN. Well, I would have to say that the process of analyzing the impact of the cuts in the Continuing Resolution has only begun, and I don't have available to me detailed analyses, but looking at the magnitude of those cuts, it is clear that they would be devastating to many of the activities in support of STEM education, in support of R&D, in support of catalyzing innovation that the Administration believes and I think many on this Committee believe this country is going to need if it is to succeed in maintaining its leadership position in the world in innovation, its competitiveness, if it is going to succeed in creating the products and industries and jobs of the future.

I do know of an analysis of what the C.R.'s cuts in the National Science Foundation would do. The estimate is that versus the 2010 enacted level, the NSF in its research directorates would make 500 fewer awards supporting 5,500 fewer people, that in the education and human resources directorate they would make 235 fewer awards and 4,400 people would be supported, in total 10,000 fewer people supported by NSF in these domains, which are in our view so critical to maintaining our competitiveness, to maintaining the technological savvy of our workforce, to maintaining the scientific savvy of our voters.

Ms. JOHNSON. Thank you. One last question. In NASA, for the fiscal year 2012, your request includes a five-year runout that shows a flat budget of \$18.7 billion per year while the federal budget requests \$18 billion, and only increasing slightly again in fiscal years 2015 and 2016. Why is the agency showing a different runout than the federal budget, and what version is correct?

Dr. HOLDREN. My understanding, Congresswoman Johnson, Ranking Member Johnson, is that the out-year budgets are only notional at this point and I think the differences is between what NASA did and what the OMB put out probably mainly reflect the last-minute character, which also attends the preparation of these numbers, but they are only notional at this point, and I think the out-year numbers simply should not be taken that seriously at this particular moment.

As you know, the President is committed to freezing non-security discretionary spending over a period of five years as a whole, and I think the numbers which are in that ballpark in both cases simply reflect that commitment on an agency-by-agency basis.

Ms. JOHNSON. Thank you very much.

Chairman HALL. Thank you, Ms. Johnson.

The Chair recognizes Dr. Broun, chairman of the Investigations and Oversight Subcommittee, for five minutes.

Dr. BROUN. Thank you, Mr. Chairman.

Dr. Holdren, at his Inauguration the President promised to "restore science to its rightful place." As a physician and an applied scientist, I applaud that promise. Since then, a number of actions taken by this Administration or inactions such as the handling of the Gulf oil spill and its decision on Yucca Mountain make me question that goal.

Dr. Holdren, I have a number of questions related to that notion of scientific integrity. When did the President ask you to deliver scientific integrity recommendations?

Dr. HOLDREN. As you know, Congressman Broun, the President on March 9, 2009, issued a Presidential Memorandum on Scientific Integrity in which he asked me to deliver guidelines that would elaborate on those recommendations in 120 days, and as you know, I missed that deadline by a very large margin. We discussed that, you and I, at a previous hearing.

Dr. BROUN. When did OSTP have that draft ready?

Dr. HOLDREN. The guidelines were released on December 17th of last year after going through many, many drafts and much discussion among agencies and within the different offices in the White House.

Dr. BROUN. What prevented the release of those guidelines from the point that you developed your OSTP draft to the final delivery of them?

Dr. HOLDREN. As I said, Congressman, there were many, many drafts of those guidelines, and what took so long was the complexity of the task of developing guidelines that were both specific enough to add significant value to what the President had already promulgated on March 9, 2009, and at the same time would be general enough to be applicable across all the departments and agencies and offices that deal with science and technology matters. That proved to be a much more demanding task than any of us thought at the outset, and it involved a great deal of debate with virtually every department, agency and office with a stake in this matter. Getting it right took us a long time, for which I have abundantly apologized.

Dr. BROUN. Whose job is it to bring about that process?

Dr. HOLDREN. My job, sir.

Dr. BROUN. Okay. Thank you. Would you characterize these recommendations as guidelines or orders?

Dr. HOLDREN. They are guidelines in the sense that we encourage the departments and agencies to build on them, and where possible even to strengthen them.

Dr. BROUN. Okay. Are there any recommendations for Presidential action on these guidelines?

Dr. HOLDREN. I think the action continues to remain with the departments and agencies and with me. The departments and agencies have been asked to respond to the guidelines by producing within 120 days of my issuing the guidelines their own detailed policies department by department and agency by agency which would reflect those guidelines but again would elaborate on them further in the context of the particular responsibilities, functions and constraints that exist within those departments and agencies.

Dr. BROUN. Very good, sir. Did you direct these agencies to implement these policies or did you simply say that they should?

Dr. HOLDREN. They are directed to implement them, and I would emphasize that the President was clear in his memorandum of March 9, 2009, that the principles embodied in that memorandum were effective as of the time that they were issued and I made sure departments and agencies understood that as well.

Dr. BROUN. Okay. What deadlines do the agencies have to implement these guidelines?

Dr. HOLDREN. There is no specific deadline, I think, other than the timeline that they are expected to produce drafts of their policies in the next 120 days, and as we get those, we will determine what we are going to ask of them going forward.

Dr. BROUN. Where are we in that process of the 120 days? What is the timeline?

Dr. HOLDREN. Well, I issued the guidelines on December 17th. A hundred and twenty days obviously would be four months from then, so one has got January, February, March, April would be the time we would expect those draft policies to be delivered, and I should say that two agencies have delivered theirs already.

Dr. BROUN. Very good. And I hope the Committee gets those policies. Are these new guidelines going to be written down so that we can—everybody in America can see these?

Dr. HOLDREN. Oh, absolutely. I mean, number one, the President's memorandum is a public document. My guidelines of December 17th are a public document and the policies of the offices, agencies and departments will be public documents.

Dr. BROUN. Very good. I look forward to those.

Mr. Chairman, my time has run out. I have got a couple more questions that I would like to give the good doctor, and I assume that we can get a written response. Thank you so much. I yield back.

Chairman HALL. Thank you.

The Chair recognizes Ms. Lofgren, the gentlelady from California, for five minutes.

Ms. LOFGREN. Thank you very much, Mr. Chairman, and Dr. Holdren, it is delightful to see you here. I am glad to be back to the Science Committee after several years deployment to the Homeland Security Committee and to get back to these issues which I love.

I live in Silicon Valley, and I know that if we want prosperity in this country, we have got to double-down our investments on science and technology, so there is much in this proposed budget that is to like. I do have—I just want to make a stray comment. You know, being from Silicon Valley, we are near Stanford, and Steve Schneider along with Jim Prall did issue a paper last year in the proceedings of the National Academy of Science where they assessed what the climate scientists, active climate scientists were saying, and found that 97 percent of active climate scientists had reached the certain conclusion that climate change is occurring and that humans are the cause of it, so I think that issue is settled, and how we respond of course is the big question for us.

As the Science Advisor to the President and Co-Chair of PCAST, you are in a wonderful position to provide advice not just on the purely science issues but a whole variety of things that touch on the future and so I want to ask, and you may not know the answer to this but I hope that you will take it up. Renewable energy is a big part of what we need to do in this country both for our economy but also for the climate change challenge that we face, and in San Jose I have very many solar energy and alternative energy companies, and one of the things that was hugely helpful to them was

the Renewable Energy Grant Program established in the Recovery Act. Now, I see that the proposal is to extend it just through 2012, and that is good, but I am wondering, could you advise the President or OMB or whoever is making these decisions that a longer extension would be much more helpful to these energy companies that are trying to make some plans? And they are going to get there without these grants and credits but they are at an embryonic stage right now. Would that be a fair thing to ask you, Doctor?

Dr. HOLDREN. Yes. Let me make a couple of comments on that. Certainly, all of these incentives, encouragements, and grants are going to be reviewed going forward to see which ones we actually need in order to encourage the development and deployment of the relevant energy sources. As you know, we have moved in what we are recommending from a renewable energy standard to a clean energy standard which embraces, in addition to the renewables, cleaner coal technologies, nuclear energy technologies, and with partial credit for reduced greenhouse gas emissions, natural gas. We think we are going to need all of those, and we want our policies going forward to reflect a balanced approach that encourages all of the cleaner energy sources that we are going to need to address the whole array of energy challenges we face, and those include staying competitive in the global energy technology market. They include creating high-quality jobs that will stay in America. They include reducing conventional air pollutants and they include reducing our dependence on imported oil, and they also of course include reducing our contribution to the dangers from climate change.

Ms. LOFGREN. Could I ask, I noticed that there was a substantial downward slope on the fusion energy science, and I have been talking to the Department and I think I understand the reason why, and I don't think I want to get more information on that but I want to make sure that we are adequately supporting the analysis at NIF because we are at a crucial stage there. We have invested a huge amount of money with bipartisan support over many, many years and I just want to make sure that we are adequately supporting the analysis that is going on right now. Do you think that we are, and do we need to discuss that further?

Dr. HOLDREN. I think we are. This is something that Secretary Chu is knowledgeable about and looking at. There are some benefits to having a Nobel laureate in physics as the Secretary of Energy.

Ms. LOFGREN. Right. He is terrific.

Dr. HOLDREN. I am looking at it. My Associate Director for Science, Carl Wieman, who also has a Nobel Prize in physics, is looking at that, among other large science and research and development projects in the portfolio. So yes, I think we are doing what we need to do in that domain.

You mentioned the decrease in funding for fusion overall. As you know, fusion is a very long-term energy project, not likely to succeed in delivering electricity to the grid much before the middle of the century, but we do very much need things that we can do for an encore after the middle of this century and so it is not our intention to starve fusion. The size of the budget relates to, among

other things, what our partners are doing, where the program is at the moment and what it will take to move it forward.

Ms. LOFGREN. Thank you very much, Dr. Holdren. I see that my time is expired, and I thank the chairman for recognizing me.

Chairman HALL. And I thank you, and welcome you back to the Committee. You have always been a good member of this Committee.

The chairman recognizes the gentleman from Tennessee, Mr. Fleischmann, for five minutes. We have all taken seven minutes so I might as well recognize you for seven minutes.

Mr. FLEISCHMANN. Thank you, Mr. Chairman.

Dr. Holdren, thank you for coming today. I represent the third district of Tennessee, which includes Oak Ridge, ORNL, of course, Y-12 and the cleanup and reclamation mission at ETTP, and since my short tenure as a Congressman, I am immersed in energy issues so I thank you for being here today. I have a few questions.

Doctor, in your testimony you discuss how the investment in research and development by this White House will help keep America competitive. However, there are many other factors that can play into our competitiveness in the world. How is the Administration actively working to identify any U.S. policies or regulations that act as barriers to trade and investment in the United States? And further, are there any particular laws or regulations that act as barriers to trade and investment in the United States? I am sorry. Are there any particular laws or regulations that you have identified as increasing the cost for U.S. business compared to foreign competitors or forcing businesses to want to locate overseas?

Dr. HOLDREN. Thank you, Congressman, for that very good question. We are addressing that in a number of domains. First of all, as you know, I am sure, Cass Sunstein, the Director of the Office of Information and Regulatory Affairs in OMB, has the mandate from the President to review the whole array of regulations that exist in this country looking for ones that may no longer be needed, that are not effective, that are too costly, that are inhibiting us in the various goals that we need to reach. You are probably also aware that there is a review underway of export controls, which we expect to yield a report soon and recommendations for reforming our pattern of export controls in a manner that will make U.S. companies able to be more active in a variety of dimensions of international trade.

You mentioned that there are a lot of ways to encourage innovation, and we are very much aware that most of the innovation that this country needs will come from the private sector. We are very much aware that, for example, making an expanded research and experimentation tax credit permanent would be a great benefit in terms of the certainty available to our companies, large and small, as they plan their R&D expenditures going forward. We want to get that done. It is proposed again in this year's budget.

I know that, responding more specifically to your question about particular regulations, that there will be some announcements forthcoming soon on that particular front but I don't want to jump the gun.

Mr. FLEISCHMANN. Yes, sir. Dr. Holdren, in 2008, the United States trade deficit in high-technology products was \$55.5 billion,

up from \$16.6 billion in 2002. The U.S. trade balance in high-technology products was last in surplus in 2001. A portion of this deficit from U.S. companies that manufacture overseas and bring the products back to the United States, even if we invest more in research and development programs and attract more professionals into high-technology fields, how do we discourage companies from taking production out of the United States?

Dr. HOLDREN. I think one of the key elements there actually comes back to this domain of science, technology, engineering, and math education. We need to create a workforce in this country that has the skills and the capabilities that make it attractive for U.S. firms to hire American workers and to stay in America in order to be able to hire them and bring them on board. That may be the single most important thing we can do, lifting the capabilities of our workforce to keep American companies here. America has always competed on the skills of our workers and our capacities to innovate, our capacities to deploy better technologies for manufacturing, to develop better products. We need to revisit those sources of our strength because we are never going to compete—at least not for a very long time, we are not going to compete with China on the cost of our labor. We are not going to compete with Malaysia and Indonesia on the cost of our labor or even with Brazil but we can and we must compete with them with a higher quality workforce, a more skilled workforce, a more technology-savvy workforce, and with continuing innovation that makes our manufacturing technologies better than those our competitors, that makes the products we are producing better than those of our competitors so that we will have those high-quality jobs that stay in this country.

Mr. FLEISCHMANN. Thank you, Doctor.

I yield back, Mr. Chairman.

Chairman HALL. Thank you.

At this time I recognize Mr. Miller, who is the ranking member on the Energy Subcommittee. Mr. Miller, you have seven minutes, sir.

Mr. MILLER. Thank you, Mr. Chairman.

Chairman HALL. You can give us back two if you want to.

Mr. MILLER. There is a remote possibility that could happen.

Dr. Holdren, there has been a great deal of attention to the issue of critical supplies of rare earths in the media. It was also a subject of interest to this Committee in the last Congress. There was a hearing in the Investigations and Oversight Subcommittee, which I chaired, on that topic and on our domestic supply of rare earths. Our subcommittee developed legislation which Kathy Dahlkemper, who was vice chair of the committee, introduced that did pass the House. It went to the Senate, where bills go to die, and sure enough, it did. But I understand that—well, I am preparing legislation at this time and I know that others are as well.

What we found is that it is not an issue that fits neatly within the jurisdiction of any of the federal departments. It kind of crosses boundaries, which is also true of the committees of Congress. It doesn't fit neatly within the jurisdiction. It does cross boundaries. I understand that OSTP has an ad hoc committee working on the issue of critical and strategic materials. Can you kind of tell us

about that ad hoc committee? Is it a formal committee? What is the status and what is that committee doing?

Dr. HOLDREN. Yes, we have had an interagency policy committee that is chaired by Dr. Cyrus Wadia in my office that has been operating since last March on the issue of rare earths in particular, and that committee has included representation from the National Security staff, from the Department of Defense, the Department of Commerce, the Department of the Treasury and so on working toward developing solutions to the current degree of overdependence on China for our supplies of rare earth metals, which are needed for our defense technologies, for our information technologies, for a number of our clean energy technologies, so these are—these rare earth minerals are crucial to us and currently 95 percent of the world's supply is being produced in China. That is not, by the way, a result of the concentration of all of the resources in China. The resources are more widely distributed. We have considerable resources of these rare earth minerals in the United States. We have—there are considerable resources in Australia and elsewhere.

The problem is that we have allowed the supply chains for these materials to migrate to China, again on grounds of economics, of low cost. We are obviously in the process of reconsidering the wisdom of having allowed that to happen. There are activities in the United States and Australia to restore rare earth mining and processing operations to diversify the supply from what it is now. We are also going to be standing up, in all likelihood, a subcommittee of the National Science and Technology Council to look at the science and technology dimensions of strategic mineral issues more broadly than just the rare earths. As you probably know, the National Science and Technology Council is a body that is nominally chaired by the President and populated by Cabinet secretaries. In practice, it is chaired by me and populated by deputy secretaries and under secretaries and administrators of NASA, of NSF, NOAA and so on, and its purpose is to address science and technology issues that cross over the boundaries that affect the interests of multiple departments and agencies. So we are on the case.

Mr. MILLER. I would like to use my remaining time to discuss climate change research. You have said earlier in testimony, you have said today that there is substantial agreement among scientists that climate change is occurring and that human activity is contributing substantially to it but there is some uncertainty about exactly how quickly it will happen and how dire it will be, and to use the phrase that an economist would use, there is a baseline scenario which is very bad and an adverse scenario that is cataclysmic. And we have heard testimony in the last four years from scientists who have said that yes, there is uncertainty but almost all the uncertainty is on much quicker, more sudden and more cataclysmic change, and they may be, as you said earlier, events that we cannot foresee or model. One that I recall is the possibility that there could be millions of tons of methane, which has much more of a greenhouse effect than CO₂, released if the permafrost in the Arctic thaws.

But despite feeling pretty confident that it is happening, you want to do more research. The Obama Administration has recommended doing more research. Others who criticize climate

change research want to do less. They want to cut the funding for NASA, NOAA, and EPA. Are you proposing the research just to prove that you are right or is there something we will do with that research? What are the consequences of not proceeding with the research into climate change?

Dr. HOLDREN. Well, first of all, I would say that, as I have noted before, while the core understandings from climate science are that the climate is changing in unusual ways, that humans and responsible for a large part of that and it is already doing a variety of kinds of harm, there is a tremendous amount of detail that we do not yet understand. We don't understand enough about the regional patterns of climate change as they are likely to emerge. As you know, climate is a complicated business, even without any human interference in it, and if we want to be able to adapt to climate change, the degree of climate change we are no longer able to avoid, we have to be able to tell farmers and fisherman and foresters and homeowners what is going to happen where they live — developing that sort of understanding of how climate is changing in particular places, which places are going to get wetter, which places are going to get drier, which places are going to get stormier, how fast are those things going to happen, which places are going to be experiencing more wildfires. We have come to understand that climate change is a challenge not just in terms of how we mitigate it, what we can do to reduce the pace and the magnitude of climate change through changes in energy policy and land-use policy and so on, but we really do need the detailed knowledge that will enable firms and individuals to adapt. That is one of the great challenges in climate change research.

We need of course, to continue the observation networks that in addition to telling us about climate tell us when particular storms are coming. We have a whole set of challenges in our earth observation satellites which in many cases are dual-purpose satellites. They are both monitoring variables related to climate but they are also telling us when powerful storms are coming and who they are going to hit.

Mr. MILLER. Dr. Holdren, when I was a child and I heard scary noises that I thought might be a monster, I pulled the covers over my head and it worked great. There was never a monster in my house, but I am not sure it is because I pulled the covers over my head. Do you think if we don't do the research in climate change, it is more or less likely to occur?

Dr. HOLDREN. Well, I would say if we don't do the research, that doesn't affect at all the likelihood that it will occur but it does affect very dramatically our ability to cope with it.

Mr. MILLER. Thank you.

I yield back the balance of my time.

Chairman HALL. I thank the gentleman. You have just made it possible for Ms. Adams to have eight minutes.

I recognize the gentlelady from Florida for I guess as much time as she consumes, just so she doesn't consume over eight minutes.

Ms. ADAMS. Thank you, Mr. Chair.

Dr. Holdren, last year, you may recall, there was sustained and vigorous debate here between Congress and the Administration about the future of NASA, the human spaceflight program. At the

end of the day with the enactment of the NASA Authorization Act of 2010, both sides went away claiming some small measure of victory but clearly neither party, the White House nor Congress, got everything it wanted. The President signed the bill, and he did so, I thought, putting the debate behind us and moving forward. A central feature of the bill was a smaller authorization level for commercial crewed services, and Congress's decision to forego implementation of the Constellation program. Yet the NASA fiscal year 2012 budget request diverges from last year's authorization bill in two respects: It proposes spending at a rate 70 percent above amounts authorized for commercial spaceflight and it significantly underfunds in fiscal year 2012 the authorized amounts for the Heavy Lift System, requesting only 70 percent of the amounts in our bill, in the Congressional bill. Why has NASA chosen to ignore the will of Congress? And I don't need to remind you that the Democrats and Republicans, House and Senate, took strong exception to last year's budget request?

Dr. HOLDREN. I do not believe that the budget is ignoring the will of the Congress. I testified on December 1 before the Senate Committee on Commerce, Science and Transportation on this question. I was asked does the Administration intend to follow the law? Are you going to obey the Authorization Act? And I said we will to the best of our ability. But I also mentioned that our ability to do so would depend on having a budget for 2011, and it would depend on being released from the constraints of the 2010 appropriations bill which prohibits NASA from making changes to the Constellation program.

We now are where we are, and in light of where we are, which is still no 2011 budget and still no relief from the constraints from the 2010 Appropriations Act, starting from there, you have to consider what it is practical to do from where you are now in pursuit of the Authorization Act's aims. We agree with the Authorization Act's aims. If you look at the numbers, you will find we are funding Heavy Lift and the associated crew capsule at quite close to the 2011 levels, which is probably the best we could meaningfully spend under the circumstances given where we are starting now. In addition, the Authorization Act recognized very clearly that the continuing operation of the International Space Station and minimizing the duration of our dependence on the Russian Soyuz to get our crew members up there was also a very high priority. And again, in terms of where we are and what we can do from where we are, we believe that the budget the President has presented is responsible and appropriate in light of the need to do as much as we can toward all of the Authorization Act's goals under the circumstances we are now in. So we don't think we are defying the will of the Congress at all. We think we are doing our best to achieve the multiple goals of the Authorization Act.

Ms. ADAMS. Okay. I will let that go for a minute. The Authorization Act gave clear direction to NASA to rely on existing contracts as it begins work on the new space launch system and multipurpose crew vehicle. Sections 302 of the bill said, in part, the Administrator shall, to the extent practical, extend or modify existing vehicle development associated contracts necessary to build a new launch system.

I realize to the extent practical is more than just a tiny loophole. But based on Members' statements during hearings, markups in the House and Senate floor, there were a clear expression that to save time and money and to capitalize on investments, technology workforce, NASA should give first consideration to using existing contracts. With that as background, how closely will the Administration follow the intent of Section 302?

Dr. HOLDREN. You are quite right, Congresswoman, that to the extent practicable is important. We don't think of it as a loophole. We think of it as a necessity. And as you know, there was a requirement for NASA to produce in 90 days an initial assessment of what it believed it could achieve in this domain. It has produced that assessment, and it has identified real challenges in meeting the timelines of the Authorization Act, namely the completion of a heavy lift vehicle and a crew capsule by the end of 2016, real challenges in meeting those deadlines under the budgets that look likely to be available. But NASA is examining what the extent practicable is for using those existing contracts. And again, I think if you look at that 90-day report, you will see that that is exactly what they are doing. They are looking for additional ways to find savings that would enable us to get where we need to go more quickly, but it is a big challenge to achieve the goals of the Authorization Act and to achieve them under the fiscal constraints that we now face.

Ms. ADAMS. Will you?

Dr. HOLDREN. We will sure try.

Ms. ADAMS. I just have a quick question. You know, we talked about STEM and everything. Do you think that human spaceflight encourages our youth to get involved in STEM, the programs, you know? Science, technology, engineering, math?

Dr. HOLDREN. Oh, absolutely. We know first of all that the response to Sputnik, the development of the U.S. space program, our moon mission and so on was an enormous boost in terms of the number of kids who went into math and science and engineering as a result of that great adventure, and we think more great adventures are in prospect and they will have that effect. We have been very clear about that from the outset. I am one of those who went into math and science because of the excitement about the exploration of space. My senior project at MIT was to design a crude Mars mission. I co-led it with another member of my aeronautics and astronautics senior class at MIT. I think it is very important stuff. Charlie Bolden thinks it is very important stuff. We after all have NASA being run by a four-time astronaut, twice-pilot and twice-commander. He is very excited about human spaceflight. So am I. We have got to do it, of course, in a manner that we can pay for. But we will do it. And the President, I have to say, is excited about it. The President, every time we talk about this, and I have talked about it with the President, with the President and Charlie Bolden together, the President has had astronauts into the Oval Office and into the Roosevelt Room seven times since he has been in office.

Ms. ADAMS. Well—

Dr. HOLDREN. We love this stuff.

Ms. ADAMS. —my question is for our youth. And we don't want to hinder their yearning to explore, now do we?

Dr. HOLDREN. Absolutely not.

Chairman HALL. Do you yield back any time at all? Okay. You did a good job. Thank you.

I recognize at this time, I am not sure I want to, but Ms. Edwards, the gentlelady from Maryland.

Ms. EDWARDS. Thank you, Mr. Chairman. That is why I adore you.

And Dr. Holdren, I want to thank you very much for being here today, and I look forward to exploring with you and others in more detail, particularly around NASA human spaceflight, the importance of what I think is a really important mission, both for human spaceflight and exploration, also for Earth sciences. But I won't take up my time here today.

What I would like to talk to you about is following up on Mr. Fleischmann's line of questions regarding research and development and manufacturing and the interrelationship between those two.

My good friend, Mr. Bartlett, from Maryland and I have introduced a bill that links research and development with manufacturing, domestic manufacturing, here in the United States because too often we make deep investments and we are at the cutting edge of R&D in so many different sectors, and then the manufacturing takes place someplace else. It takes place in China, in Germany and lots of other places. And I think that we can actually do some things through our tax policy and across agencies to incentivize not just the R&D and making it permanent which is so important, particularly for small firms. The big guys will figure out a way to go from year to year if it is not permanent. It is the small, innovative, creative nimble firms that really struggle when we don't have a permanent tax credit, then linking that to domestic manufacturing. So I have been able to visit some firms out in my district who are just doing the most amazing work around mapping the human genome and, you know, really the most cutting-edge science. But they are small firms, and they want to be able to do that manufacturing domestically because it connects their R&D people to the manufacturing line. If there is an opportunity to make changes along that manufacturing line, you have got your R&D people right there.

So I hope that you will look into the legislation that has been introduced by Mr. Bartlett and myself along with Congressman Sarbanes and others as a way to get there.

One of the recommendations in the report that was released by the White House in 2009 that you cite in your testimony, A Framework for Revitalizing American Manufacturing, is to improve the coordination of manufacturing R&D programs through the National Science and Technology Council. And so I wonder if you could tell us what the status is of that interagency process and how we can look at all of these, particularly civil scientific agencies, to make sure that we have got a sort of similar pathway to their success. And so if you could give us a brief overview of the Administration's strategy and vision to revitalize manufacturing, including federal R&D investments in creating jobs here, that would be helpful, and any plans to develop a strategic plan for manufacturing R&D so

that we don't let everybody else take our good ideas and build stuff and create jobs.

Dr. HOLDREN. Well, Congresswoman Edwards, I thank you for that question, because it enables me to say we are doing a lot. We are just in the final stages of setting up a National Science and Technology Council subcommittee on advanced manufacturing under the technology committee, standing committee, of the NSTC. It will have three co-chairs, a co-chair from NIST, the National Institute of Standards and Technology, one from DoE, and one from the Department of Defense. They are currently in the last stages of vetting for those roles. We also have underway a study requested by the President of his Council of Advisors on Science and Technology, PCAST, on advanced manufacturing which is nearly complete and which we hope actually to brief to the President in just a couple of weeks.

We have an assistant director of OSTP for advanced manufacturing. Sridhar Kota has been in place for the past couple of years on leave from his professorship at the University of Michigan, and one of the things that Professor Kota has been working hardest on and interacting with folks from the business and academic communities around the country, is how one links discovery and innovation in our universities with translating those discoveries and innovations into commercial products in the private sector. And one of the things I would note is there is a wonderful example of how this can work at the University of Michigan from whom we borrowed Professor Kota which is a very large, state-of-the-art nanotechnology manufacturing laboratory and experimental facility in which businesses of all sizes can come and use those facilities to develop their own products and their own approaches, including small businesses that could never afford this kind of equipment themselves. And it is a wonderful example of how we can do better at translating the capabilities of our universities and for that matter, our national laboratories into tighter interactions with the private sector and particularly, as you point out, the smaller businesses that wouldn't be able to muster the capital to develop these kinds of innovation and experimentation capacities on their own.

Ms. EDWARDS. Thank you very much, and I just want to point you to something that we are doing in Maryland, and it is relatively new, a new initiative by our governor, and it is essentially to create that kind of investment fund that could spur the kind of investment that is tough to get in this economy and particularly for small firms. And I think whatever we could do to encourage states on their own to do that, it just bolsters what is happening with our federal agencies.

Lastly, I would just want to ask you, we are in an environment here, considering this continuing resolution where it feels odd to talk about new investments in science and technology and research and the things that are actually going to make us grab hold of the 21st century when we are cutting in this Congress, this CR, just about every scientific agency out there. It is mindboggling to look at the kind of cuts across a number of agencies where the investments that we need to make for the future are exactly the ones that are being put on the chopping block. And I think that is particularly true for NASA, and perhaps it is that the White House

and the President could do a much better job of helping the public understand the value of investment in NASA and space exploration and the science that comes out of that because it really does translate into what happens in our broader commercial sector and the way that we remain competitive. So I look forward to the President, you know, just speaking out because otherwise, Democrats and Republicans alike just put NASA and our other scientific agencies right on the chopping block as though it is something that we can afford to discard and still hope to be even remotely competitive in this century.

And with that, I would yield the balance of my time if I have any, Mr. Chairman.

Chairman HALL. I thank the lady. You are right on the spot, right on the dot here.

I recognize now the former Chairman Bart Gordon's favorite Republican, Mr. Rohrabacher from California.

Mr. ROHRABACHER. Thank you, Mr. Chairman, I would like to submit now for the record a list of 100 prominent scientists who have serious disagreement with the man-made global warming theories that we have talked about today.

Chairman HALL. Without objection.

[The information follows:]

JAMES GOODRIDGE
CALIFORNIA STATE CLIMATOLOGIST (RETIRED)

LAURENCE GOULD, PH.D
UNIVERSITY OF HARTFORD

VINCENT GRAY, PH.D
NEW ZEALAND CLIMATE COALITION

WILLIAM M. GRAY, PH.D
COLORADO STATE UNIVERSITY

KENNETH E. GREEN, D.ENV.
AMERICAN ENTERPRISE INSTITUTE

KESTEN GREEN, PH.D
MONASH UNIVERSITY

WILL HAPPER, PH.D
PRINCETON UNIVERSITY

HOWARD C. HAYDEN, PH.D
UNIVERSITY OF CONNECTICUT (EMERITUS)

BEN HERMAN, PH.D
UNIVERSITY OF ARIZONA (EMERITUS)

MARTIN HERTZBERG, PH.D.
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DOUG HOFFMAN, PH.D
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JAMES F. LEA, PH.D

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PETER R. LEAVITT
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Mr. ROHRABACHER. These scientists I would like to add are chairmen of science departments at major universities, they are at internationally respected institutes of science, and there are many more than just 100 as you are well aware.

Doctor, in the past you have made public statements referring to those who question your assessment on man-made climate change, and you have labeled them as deniers. The term deniers is only commonly used in one other context and that is to question whether or not the Holocaust actually took place. Do you believe that this is an appropriate term and what purpose does it serve except to stifle debate rather than to have an honest discussion?

Dr. HOLDREN. Congressman Rohrabacher, when I used the term, I only intended to use it in its most straight-forward interpretation. These are folks who are denying the reality of a particular thing, namely climate change. It was not my intention to compare them to Holocaust deniers and to the extent that that is the impression given, I regret it. And for that reason, I will doubtless choose to use other words in the future.

Mr. ROHRABACHER. Thank you very much. Now, with that said, of course, we have a disagreement on whether or not climate change or what used to be called global warming and then when things changed, it became climate change. And now maybe it is going back to global warming again. We know there have been these cycles throughout the history of the planet where it has become warmer or colder, and I take it from your testimony today that this increase that you are asking for research into climate change is going to be mainly aimed not at proving whether mankind is responsible because what I have found is that is usually used to justify controlling human behavior rather than trying—because that is based on the fact that the change is based on human behavior, but instead, on perhaps researching things that can help us adapt to what could be natural climate change.

Dr. HOLDREN. I would say first of all that you are correct that part of the increased research activity that we propose in the President's budget would relate to adaptation, and that adaptation would be germane, whether changes in climate had been caused by humans or caused by natural forces. That much is certainly correct.

Mr. ROHRABACHER. Right.

Dr. HOLDREN. But that is not the only activity in climate change research that we would continue to support. We have extensive observing networks, satellite-based observations, on-the-ground observations which are helping us understand how climate is changing. We have extensive analytical and modeling activities which help us try to understand the extent to which human activities are contributing. No one in the climate science community denies that climate has changed naturally over the millennia and that there continue to be natural forces influencing the climate. The question is what is the relative magnitude today of the natural forces and the human influences.

Mr. ROHRABACHER. Right.

Dr. HOLDREN. We intend to continue to conduct research which will shed light—to support research which will shed light on that question as well.

Mr. ROHRABACHER. I would hope that the end result of scientific activity is to make our lives better and not to control our lives in the name of saving the planet.

But one thing we can really agree on, and we can agree on what you have just said as well, I might add, is when I am looking at your—also the research for the Department of Energy, we talk about a certain decrease, but I want to pinpoint it because it might not be aimed directly at what I am worried about. Number one, I think that we have provided funds for fusion energy research for a long time and have very little to show for it. So that perhaps does justify some bringing down the level of research. But I also understand it says nuclear R&D in general, research will decrease by eight percent, but I have in front of me a figure. It says that there are \$67 million going to be spent for helping the Small Modular Reactor Deployment program to assist in developing and licensing of these small modular reactors. Now is that \$67 million, is that an increase? The overall level of R&D would decrease, but that, for small modular reactors, would increase, is that correct?

Dr. HOLDREN. Yes, that is correct. The increase for small modular reactors is for work that would provide the analytical basis to assist in the licensing of this new class of reactors which have a great deal to recommend them, by the way—

Mr. ROHRABACHER. Yes.

Dr. HOLDREN. —as potential contributors to our electricity supply and to our balance of payments, I should say, because we could market them rather widely.

Mr. ROHRABACHER. Exactly. Let us note that where we have many disagreements, we also have many agreements, and this happens to be an area that I have agreed with the Administration, for example, much to the dismay of some of my own colleagues on the space proposals that have been made about NASA, and I really agree thoroughly on this concept of trying to get down to business so that we can go into the business of manufacturing small modular nuclear reactors. It would both have a positive impact on energy, and it is consistent with the climate problems that some people are worried about. But I am also worried about air pollution whether this would affect as well.

So thank you very much, and I appreciate you being here today.

Chairman HALL. You yield back?

Mr. ROHRABACHER. I yield back.

Chairman HALL. I note Mr. Luján who was here earlier, the gentleman from New Mexico, you have five minutes, sir.

Mr. LUJÁN. Mr. Chairman, thank you so very much. Dr. Holdren, thank you for taking the time to be with us today as well. I appreciate the Administration's commitment to research and development and innovation as key to the Nation's economic development and international competitiveness.

I am particularly passionate about capitalizing on our investment in R&D, transforming new scientific discoveries and technological capabilities that are produced by R&D into new commercial products, new businesses that can create jobs, namely those that we see especially with our DoE national labs, DoD research facilities, Air Force research labs, NNSA facilities which are often overlooked as a key component of innovation of the country, especially

as they lead to opportunities with working small businesses. We need to find better ways to open up opportunities. There are entrepreneurial lead programs today for scientists, physicists, nuclear engineers to work with entrepreneurs.

But I think that they are only as good as they are on paper. We need to find a better way to engage these experts with our entrepreneurs and small businesses, even to the extent we are able to take advantage of the modeling and computer capacity that we have to turn these new ideas together. Without the important step of tech transfer, our competitors will only be the ones who reap the benefits. Oftentimes we see technology that is invented and thought of here in the United States to even mature and be commercialized outside of the country, and we need to change that.

I am very happy to announce that myself with my co-chair, Representative Frank Wolf of Virginia, have started a bipartisan technology transfer caucus to begin to look at ideas and ideals around the Bayh-Dole legislation which concentrated most of its efforts with universities, but making sure that we not forget the applications associated with our national labs and science and research taking place in these areas.

The bipartisan technology transfer caucus in the House, we look forward to working with the Administration and with the many capacities I think that have to still present themselves.

You stated in your prepared testimony that as part of the President's Start-Up America initiative a broad set of federal agencies will launch a coordinated series of policies that ensure high-growth start-ups have unimpeded access to capital, expanded access to quality mentorship, an improved regulatory environment and a rapid path to commercialization of federally funded research. I applaud those remarks, and I support them strongly, but I would like to hear more about what is actually going to be done in these areas. My concerns are with the naming of the tech transfer coordinator under DoE, for example, that we have yet to rapidly move toward making sure they have access to the needed support they need to move this forward. With the collapsing of Creative Cooperative Research and Development Agreements—in near past with the funding that was accelerated in the 1990s, and through the early years of the Bush Administration, we saw it go away. And it seemed to me that when we talk to small businesses, this was an important tool that was used.

And so I am interested to hear your thoughts in these regards and how we might be able to work together to make sure we are able to spur this forward.

Dr. HOLDREN. Well, Congressman Luján, I can only applaud what you have said about the importance of technology transfer and the importance of the national laboratories in this domain. My own first job after getting my Ph.D. was at the Livermore lab. I almost went to Los Alamos.

And the potential there for doing more to enable discoveries made in the national laboratories to cross the boundary into the commercial sector is enormous.

You asked about the Start-Up America initiative. That was only rolled out about a month ago, and when we did, we announced the participation of a number of the country's leading high-tech entre-

preneurs and venture capital folks who have pledged their cooperation in setting up the specific activities and institutions that for example are going to provide the mentorship that the program talks about where successful high-tech entrepreneurs have agreed to mentor budding entrepreneurs to increase their probability of success and where the venture capital community is stepping up in the form of many of its real leaders to get this done.

So it is a new initiative, but we do not intend this to just be about an initial meeting where all these high-powered folks come and pledge their participation. This effort is being led in OSTP by my deputy director for policy, Tom Kalil, who is immensely energetic and determined to work with others in the Administration and the Congress to make this a success. And I am delighted to hear about your tech transfer caucus that you and Congressman Wolf are heading. That can only be a benefit.

Mr. LUJÁN. Thank you very much, Dr. Holdren. Mr. Chairman, I think this is an area where visiting with former Members and Members that we have today, that this is an area where we can work together to make sure we jump-start the opportunities for small businesses.

I have some other questions around regional innovation clusters and minorities in STEM, and Mr. Chairman, if there is no objection, I would like to make sure that we submit this into the record and maybe we can work with Dr. Holdren to get these answered later. But I very much am eager to see how the national labs, especially NNSA facilities, will be included in that effort. So Mr. Chairman, thank you for your indulgence.

Chairman HALL. Thank you. Without objection, they will be.

And Dr. Holdren will answer those, will you not, by mail?

Dr. HOLDREN. I will.

Chairman HALL. And I hate to tell Mr. Sarbanes we have two more. Has Mr. Sarbanes left? He is so patient. I was going to give him ten minutes. I wish he stayed. Mr. Hultgren from Illinois, you are recognized for five—I started to say five seconds, five minutes.

Mr. HULTGREN. I would talk really fast. Thank you, Mr. Chairman and thank you, Dr. Holdren.

I want just to talk briefly. I am concerned about funding for Department of Energy's Office of Science, and specifically, the High-Energy Physics Program which we all know is in a period of transition. The Administration has notified Congress that it intends to shut down the Tevatron at Fermi National Accelerator Laboratory, or Fermilab, which is in my district, 14th Congressional District, as originally planned at the end of Fiscal Year 2011. With the end of operations at this record-breaking machine, Fermilab is ready to transition to new programs including the Long Base-line Neutrino Experiment (LBNE). The LBNE is to be the anchor project for the deep underground science and engineering laboratory or DUSEL at the Homestake mine in South Dakota. Originally planned by the National Science Foundation, a study is now under way to recommend how to proceed with DUSEL under a revised stewardship agreement between DoE and NSF.

I just had some questions about current status of funding for DUSEL for Fiscal Year 2011. Has NSF identified the resources to

keep DUSEL under way while the study is conducted and decisions are being made on the path forward for this project?

Dr. HOLDREN. My understanding is that NSF and DoE have reached agreement on a plan to keep DUSEL moving. I have not actually seen that agreement yet, but I have been informed by my associate director for science that it has been reached, and we will have it shortly. But I am assured that it will succeed in keeping the DUSEL project going.

Mr. HULTGREN. Great. And as you hear things, we are interested in that, and I would love to hear obviously what the next steps are there. The President's Fiscal Year 2011 budget requests of \$797.2 million for high-energy physics overall would amount to a freeze at the Fiscal Year 2010 enacted level when other programs in the Office of Science are slated to increase from 21 to 24 percent. Why is there such imbalance between the basic research portfolio in the Office of Science?

Dr. HOLDREN. Well, I would say that the kinds of restraints imposed on us by these fiscal times has required some very hard choices, and I have been striving to make clear as I talk about this budget that it has had to either hold flat or in some cases even reduce things that we would much rather have increased. But it becomes a difficult exercise in priority setting to decide what we absolutely have to keep going as opposed to things we would prefer to keep going or expand.

I think high-energy physics remains an important area. The request for high-energy physics in 2012 is almost \$800 million. This is not chicken feed. It is, however—if I had my choices in the best of all possible worlds, it would be more.

Mr. HULTGREN. Real quickly, within the overall funding request for high-energy physics, am I correct that the President proposes funding for the two new projects at Fermilab that are important to its future as the Nation's only laboratory for particle physics research?

Dr. HOLDREN. Short answer is yes.

Mr. HULTGREN. I like short answers, especially when they say that. So that is good. And last, and I appreciate your time and your help with this, is the \$17 million that is requested for the long base-line neutrino experiment sufficient to start this project at Fermilab and the transitions from running the Tevatron?

Dr. HOLDREN. It is my understanding from Dr. Brinkman, who heads the Office of Science, that that is the case.

Mr. HULTGREN. Okay. Well, again, thank you very much for your work. I do know these are difficult times. We want to be a part of that to make sure that we continue great work that is happening, make sure that we don't cut things short that really are looking toward the future. I know it is so important to be looking at immediate transition of projects that we have but also looking to the future and making sure that our Nation stays on that forefront.

So Dr. Holdren, thank you so much for being here. Look forward to working closely with you during these difficult times and hopefully as times get better as well. So thank you.

Dr. HOLDREN. Thank you.

Mr. HULTGREN. Thank you, Mr. Chairman.

Chairman HALL. The gentleman yields back. I recognize the gentleman from Michigan, Mr. Clarke, for five minutes.

Mr. CLARKE. Thank you, Chairman Hall. Ranking Member Johnson, Dr. Holdren, I am new to this Committee. In fact, I am new to Congress. But I am born and raised in the Motor City, and I represent the City of Detroit right now. And that city's achievements in manufacturing and automotive technology was recently highlighted by the artist, Eminem, in a recent Super Bowl ad, and I am really proud of the cars, you know, especially in the district that I represent. General Motors manufactures the Chevy Volt which I believe represents the best in plug-in hybrid auto technology.

Just on a personal note, and I am doing this also because I want to promote my city and really what it meant to me. My dad was an immigrant from India who came to this country 80 years ago, came to Detroit specifically for the purpose of working in the Ford Foundry. So manufacturing is in me. It is what made my city great.

Our lack of focus on that, though, I believe has also led to the decline of the southeast Michigan region, temporary decline. But also as our President noted in the State of the Union, it is in new, American manufacturing is how we can help bring more stability to our families financially, create a really enduring prosperity for our country and great products that we can sell worldwide that folks in other countries can enjoy.

Anyway, those are my preliminary remarks. I appreciate your at least giving me the time to at least, you know, share with you the importance of metropolitan Detroit, the importance of investing in manufacturing and in that region. It is not only going to help Detroiters, it is going to help this country.

In the proposed budget, can you give me some examples on how this proposed budget would help further develop and deploy new technologies that really can advance manufacturing here in this country, if you are able to? And then I also have—let me just give you the second question. It is really related to that. It is if you can comment on the impact of federally funded R&D in terms of creating those small businesses that create jobs as well, especially in the manufacturing-related sectors.

Dr. HOLDREN. Well, first of all, Congressman Clarke, I can only underscore and agree with your comments at the outset about the importance of manufacturing in this country, about the importance of manufacturing obviously in Michigan and Detroit. I already mentioned a particular activity at the University of Michigan linking their capacities in nanotechnology with the small business community and the opportunities for small business to use facilities and equipment they wouldn't be able to afford on their own. My understanding is that that facility has already spawned a number of successful start-ups and launched them into domains in which they are succeeding.

I would mention the National Nanotechnology Initiative and the funding it receives in the 2012 budget as a good example of feeding the underpinnings of advanced manufacturing. Nanotechnology is going to be immensely important in the manufacturing domain going forward. We have to invest in maintaining and extending American leadership in this domain, and it is a domain in which

small companies as well as large ones are succeeding and are going to continue to be able to succeed.

Another domain that is very important is the domain of networking and information technology. Again, there is substantial support for that in the budget. It is important in part because the use of information technology in advanced manufacturing, using information more effectively to save energy, to save materials, to make products to finer tolerances, to make them in new ways is going to contribute to our capabilities in the advanced manufacturing domain. I think you find all across this budget, in the budget for NIST, the National Institute of Standards and Technology, in the budget for DoE, even the budget for the Department of Defense, which of course, is very interested in advanced manufacturing as reflected in their co-chairmanship of the embryonic National Science and Technology Council Committee on Advanced Manufacturing. There is a lot of support for that domain. The President understands it is important. One of the studies that the President requested from PCAST was that we look at the potential in advanced manufacturing and make recommendations for what more we can be doing, and we will be doing that very shortly.

Mr. CLARKE. May I have an opportunity—

Chairman HALL. Yes, sir?

Mr. CLARKE. —to ask one more follow-up on this. Just one, sir.

Chairman HALL. The Chair recognizes you for another minute.

Mr. CLARKE. Thank you very much, Mr. Chair. Also to the doctor, we have got a great research university in my district whose capacity for R&D has grown dramatically in the last 30 years. That is Wayne State University, and I look forward to some type of partnership with that university and some of your agencies.

Just my last point on this, I would like the opportunity to actually comment on STEM and how we can make sure that we can get teachers trained in that area in inner-city districts like my own. But for the sake of time, I will just ask this last question. Can you comment on the impact on jobs in the economy should the Federal Government really slash its investment in R&D as proposed in the current continuing resolution that we are considering this week?

Dr. HOLDREN. First of all, I would say that most economists who studied economic growth over the decades have concluded that well over half, some say as much as 80 percent, of increases in productivity in the United States over the last 50 years have come from innovation, have come from our past investments in science and technology and innovation. Nobody could predict the future with a clear, crystal ball. But looking at the history of the contributions of science, technology, and innovation to our economy, it would seem to be imprudent to cut off our investments in that domain if what we are interested in is economic growth and prosperity. I think the President said it very well in his speech in North Carolina some weeks ago when he said if you are trying to make an overloaded airplane lighter, you don't do it by throwing overboard the engines. And really, science, technology and innovation have been the engines of our economic growth over the decades. They are expected to be the engines of our economic growth going forward as long as we don't throw the engine overboard.

Chairman HALL. Do you yield back? Ms. Johnson and I are probably going to give a prize for the one that represents their district better, and Mr. Clarke, you were the one today.

All right. Let us see. Who will we recognize now? Mr. Lipinski. He is a Ranking Member of the Research and Science, Education Subcommittee, and he has a lot of other obligations. Thank you for coming and including us today. We will recognize you for five minutes.

Mr. LIPINSKI. Thank you, Mr. Chairman. I want to thank Dr. Holdren for spending all this time with us today. He has probably been here since I have cast 14 votes, been here, been to another committee, asked questions, went to a delegation lunch, and I am back here and you are still here. I appreciate that.

I want to associate myself with the comments of Mr. Clarke and also Ms. Edwards on manufacturing. It is critical. I am not from Detroit, but I also did love that Eminem commercial. I don't love Eminem either. He's alright, but I don't know. But it was a fantastic commercial. It is sort of what we, I think, really need to get that back in this country. We need to be building things, and I think you understand that. You were just talking about nanotechnology. I have said many times in this Committee that I have drunk the nanotech Kool-Aid. I believe that it is critical in so many different areas to the future economic growth and jobs, and I think the United States has to be on the forefront of that.

I was pleased to see in the President's 2012 budget that the funding for nanotechnology research was modestly increased, and I was particularly interested to see substantial new investment in nanomanufacturing research.

So one thing that I think is very critical, and hopefully we will get through this quickly—I have one other question in one other area—is what more can be done for nanotechnology commercialization? That is an area that I have been very focused on in my time on this Committee since I have been in Congress. What more can be done in commercialization? What are your plans?

Dr. HOLDREN. Well, I think there is a substantial amount of effort in the National Nanotechnology Initiative moving in that direction. In fact, you mentioned that it is up in the 2012 budget, and the reason it is up is precisely to support some areas that are moving successfully in the direction of commercialization but need some more help to get all the way there.

I would also say that the model I mentioned before of having facilities that have the advanced equipment that is needed to do cutting-edge research on nanotechnology and how it can be commercialized, the model of that facility at the University of Michigan which is available to the private sector to work with, that is a model we ought to expand. And we ought to do it with our national laboratories as well as our great research universities as a way to help bridge this gap that sometimes occurs between discovery and commercialization.

Mr. LIPINSKI. Just to make the Chairman proud, Northwestern University, my alma mater, is doing a great job of nanotech research, although it is not in my district. It is close enough.

One other thing I wanted to talk about is you know that one of the most significant accomplishments of this Committee last Con-

gress I think is the Congress' passage of the America Competes Reauthorization, and there is one particular provision I wanted to talk about. It is Section 105 which is based in part on the genius grants, the Genius Act that I introduced with Representative Wolf. This section gave the research agencies broad, new authority to offer prizes for innovative research or solutions to critical problems. I think the prizes as a complement to traditional research funding mechanisms, not as an alternative but a complement, can offer a new way to incentivize high-risk, high-reward research and generate excitement on the frontiers of science and engineering. I know that COMPETES was passed too late for this section to be reflected in this year's budget, but can you comment on whether you see this authority being helpful in the future and how you think research agencies might take advantage of this language about giving authority to do the prizes?

Dr. HOLDREN. Well, certainly the Administration, President Obama, are very enthusiastic about COMPETES having been reauthorized. The President was delighted to sign that Reauthorization Act. OSTP is already in the process of implementing that Reauthorization Act. I happened to write a blog celebrating the passage of that. Very shortly afterwards it appeared on the White House website, but we have done a number of things in direct support of that act. We have established a National Science and Technology Council Committee on STEM education. We will meet for the first time in just a couple of weeks. That is Section 101. We have established as I mentioned already an interagency working group on advanced manufacturing R&D under the NSPC. We are in the process of establishing an interagency public access committee, which is Section 103, which I think you referred to. We have an interagency group on scientific collections that is working on the aspect of America COMPETES there. And you mentioned competitions and prizes. We are enormously enthusiastic about the potential of competitions and prizes. A lot has been happening there. I am sure you know about the Automotive X Prize where \$10 million in prize money put out by the private sector in a competition that was co-sponsored and co-organized with the Department of Energy led to \$100 million of investments by the competitors competing for the \$10 million prize on how to make automobiles that would get more than 100 miles per gallon of gasoline equivalent.

We now have a one-stop shopping website called Challenge.gov where all the existing prizes and challenges that are out there that are documented so that folks can find them and identify things they would like to compete in. We think this is a very high leverage domain and again are very happy indeed by the encouragement provided in the reauthorization of America COMPETES for that direction. So we are great fans of this Committee and what it has managed to do through the original America COMPETES and now its reauthorization. This is great stuff.

Mr. LIPINSKI. Thank you, Dr. Holdren, and I yield back.

Chairman HALL. I thank the gentleman. Finally, the very patient Mr. Sarbanes. I am glad to recognize you for five minutes where I don't have to say I didn't see the woman come in here with that hat on. You are recognized.

Mr. SARBANES. I appreciate it, Mr. Chairman. Thank you very much. I understand I stepped out just before you called me. I will try not to do that again.

Chairman HALL. We were going to wait for you if you came after dinner.

Mr. SARBANES. Dr. Holdren, thank you for being here today. I appreciate your patience.

I wanted to just go back to the climate change thing real quickly because Congressman Rohrabacher was pointing to a group of I guess you might call them dissenters on the view that climate change is now being driven by this sort-of a man-made phenomenon at this point, and I just wanted you to comment, if you could, on the notion of what it means to reach scientific consensus. Obviously, that can't mean that we will have 100 percent universal agreement on whatever the particular scientific judgment is that needs to be made. We are charged with making policy judgments and setting a program direction and so forth based on looking at the preponderance of evidence and so forth. And isn't that the case here? I mean, however many scientists there may be out there who indicated some anxiety or concern or resistance to the notion of climate change, there is an exponentially greater number of people, it appears to be, on the other side who really believe this is happening. And we have to base our judgments on sort of the balance of what is there, in this case, I think a very heavy balance in that direction, and that would constitute a consensus for purposes of making policy, would you not agree?

Dr. HOLDREN. I would agree. I have not seen the particular list of 100 that Congressman Rohrabacher mentioned. I can only say that in the past that when such lists have materialized, most of the names on them were folks who were not actually climate scientists. And one could reasonably assume that they had not spent as much time in the scientific literature of climate change as those who do that as a full-time profession. As was mentioned earlier here, rather serious and systematic studies of what professional climate scientists believe have indicated that well over 95 percent of professional climate scientists believe the basic propositions that I have summarized here now a couple of times about climate change going forward in ways that are highly unusual against the backdrop of natural variations, that humans are very likely responsible for a large part of that and so on.

Mr. SARBANES. I appreciate that answer. I am going to jump to another topic real quick.

Dr. HOLDREN. Let me just say if I may, it would be a very odd thing indeed if all of the academies of sciences of the world, the Chinese Academy, the Russian Academy, the U.S. Academy, the Brazilian Academy had all reached this conclusion. These academies are rather conservative bodies. They don't lightly issue reports and statements about matters of science bearing on public policy. The fact that every academy of science in the world virtually has done this should have considerable weight in telling us where the scientific consensus is. And you are absolutely right, there will always be dissenters, but they are very much in the minority and the question is why should we bet the welfare of the public against

the very long odds that the vast majority would turn out to be wrong and a very small minority would turn out to be right?

Mr. SARBANES. Thank you. I was encouraged by the President's fiscal year 2012 budget with respect to the investments being made in some of the critical areas that we have talked about today. I wanted to ask you about STEM education. The President announced this particular recommitment to that investment at Parkville Middle School a few days ago which is located in my district, and we are very proud of the STEM education program that they have there.

I understand there is a group coming together that is going to try and look at where there might be some duplication of effort or how better to coordinate across agencies the delivery of STEM education and that emphasis, and I applaud that. And just looking for example at the relative resources committed to the Department of Education for that effort versus say the National Science Foundation and other agency commitments is going to be important. But what I wanted to ask you is, how do you think we compare to our peer nations? I mean, the Parkville Middle Schools of America are doing a good job with STEM education, but how much is that the exception versus the rule, particularly when you lay it against what is happening in these nations that are competing with us with respect to that kind of investment?

Dr. HOLDREN. First of all, as you know, in the various standardized tests on math and science, the United States has not been doing well in relation to our competitors. We tend to rank variously between 17th and 25th among the nations of the world in standardized math and science tests in various grades, ranging from 4th to 8th to 12th. And what is even more discouraging is our rankings tend to get worse as you go up in age. So we are doing worse in the 8th grade than in the 4th, and we are doing worse in the 12th grade in comparison to our competitors than in the 8th.

On the other hand, it remains true that we have by far the greatest college and university system in the world, and one of the reasons we continue to lead in so many fields of math and science and engineering is that the strengths of our college and university system in some sense have been at least partly compensating for the shortcomings at K through 12. But we need to lift our game in both places. We need to lift our game in K through 12. We need to lift our game in colleges and universities because even as good as the colleges and universities are, they are losing too many people who come in enthusiastic about science and technology and then end up drifting off into other fields because their teachers aren't inspiring enough, their curricula aren't stimulating enough, and we have got to fix that. We have got to fix it at K through 12.

I would also say, though, by way of balance that when I talk to my counterparts in China and Japan and South Korea as I did this past summer in joint commission meetings on science and technology cooperation that we have with those countries, they still envy our school system because they think although we are doing worse than they are on standardized tests, they believe that we do better at inculcating creativity in our kids. And they complain that their systems are not doing as well in terms of creativity and that is hurting them ultimately in innovation.

I think there is a lot that we need to get to the bottom of as we try to understand what we do well and what we do not so well in K through 12 education, and something that is very refreshing is that over the past decade, there has been a growing emphasis on serious systematic research to actually understand what works and what doesn't work, rather than simply basing our opinions about this matter on anecdotal experiences and what we may have experienced ourselves in our schools. Our STEM education effort in OSTP is now being led by our Associate Director for Science, Carl Wieman, whom I mentioned before is a Nobel Laureate in physics, but he is focused far more these days on STEM education, which has become his passion, other than on just physics itself. And Carl is overseeing the setting up of the National Science and Technology Council Committee on STEM education that is going to do this work you mentioned of looking across all of our STEM education efforts across all the agencies that engage in this, looking for duplication, looking for symbiosis and looking for more rigorous application of what research shows about what works in this domain.

Chairman HALL. Will the gentleman yield? Before you yield back your time, Mr. Rohrabacher is not here, but if he is here, I would imagine that he wouldn't agree with your dismissal of those 100, either you or the witness'. There just might be some scientists in there that know what they are doing, and I would guess that maybe there is not one in the 100 that would have seven years ago predicted a catastrophic sea level rise of 15 feet when it is only two or three or four inches. Don't pooh-pooh what you call the minority of people that don't believe what is being trying to be sold as a majority of scientists. We need to get them beforehand and have you a chance to visit and inquire of them, us to have a shot at them, and then decide, okay? Thank you.

Is there anyone else here? All right. Thank you, Dr. Holdren, for your valuable, willing testimony and congenial testimony and the members for their questions. The members of the Committee may have additional questions for you, Dr. Holdren, and I would ask you to respond to them in writing if you will, sir.

Dr. HOLDREN. I will, and thank you very much, Mr. Chairman, and the Ranking Member as well.

Chairman HALL. The record will remain open for two weeks for additional comments from Members. The lady from Dallas Ms. Johnson, do you have anything further?

Ms. JOHNSON. No, I just want to thank the witness.

Chairman HALL. With that, she just wants to thank the witness. I join her. We are adjourned.

[Whereupon, at 1:35 p.m., the Committee was adjourned.]

Appendix:

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

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

Questions submitted by Representative Ralph M. Hall

Q1. It is my understanding that departments/agencies participating in the U.S. Global Change Research Program (USGCRP) are assessed a certain amount each year to support National Research Council studies, the U.S. Global Change Research Program Integration and Coordination Office (USGCRP ICO), several international programs (e.g., International Geosphere-Biosphere Programme (IGBP), and the Earth System Science Partnership (ESSP), etc.), and several IPCC activities (e.g., the IPCC WGII Technical Support Unit (TSU) and travel for U.S. scientists to participate in IPCC meeting).

Q2. For each of Fiscal Years 2008-2012, 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.

A1. Please see the attached table and technical notes.

USGCRP Centrally-Funded Activities	FY2008	FY2009	FY2010	FY2011 Distributed	FY2011
	Distributed Cost Budget (FY2009 Activities)	Distributed Cost Budget (FY2010 Activities)	Distributed Cost Budget (FY2011 Activities)	Cost Budget Supplemental (FY2011 Activities)	Distributed Cost Budget (FY2012 Activities)
	Actual	Actual	Actual	Estimate	Request
USGCRP National Coordination Office (NCO):					
Subtotal	2,172,643	2,017,295	2,130,330	821,011	2,745,348
National Research Council					
Subtotal	800,000	360,000	365,000	0	589,681
International Programs					
IGBP	450,000	450,000	450,000		
IHDP	150,000	150,000	120,000		
WCRP	120,000	0	118,000		
DIVERSITAS	100,000	100,000	114,000		
ESSP	60,000	60,000	0		
START	600,000	640,000	568,000		
Subtotal	1,400,000	1,400,000	1,400,000	0	1,400,000
IPCC Technical Support Unit					
Technical Support Unit	268,091	1,317,953	1,526,548		1,000,056
Travel for US Scientists	214,015	328,268	613,231		467,935
Subtotal	482,106	1,646,221	2,139,779	0	2,067,991
Other: NSF Administrative Cost (4.95%) (1)	159,361	216,000	243,627	53,940	316,236
TOTALS (4) (5)	5,014,100	5,639,516	6,278,736	874,951	7,119,256
USGCRP Participating Department/Agency Assessments					
DOD	0	0	0	0	0
DOE	393,700	439,700	596,300	83,120	676,329
DOI	80,600	116,800	159,700	21,874	177,981
DOS (2)	0	0	0	0	0
DOT	3,100	3,400	7,100	875	7,119
EPA	49,600	68,700	63,900	8,750	71,193
HHS	155,000	161,400	14,200	1,750	14,239
NASA (3)	2,675,200	2,940,200	3,066,600	426,976	3,474,197
NIST	0	0	0	0	0
NOAA	731,600	913,700	1,309,700	182,865	1,487,925
NSF	635,500	704,100	780,800	108,494	882,788
SI	18,600	20,600	21,300	2,625	21,358
USAID	43,400	48,100	60,300	8,750	71,193
USDA	179,800	223,300	198,800	27,998	227,816
TOTALS (4) (5)	4,966,100	5,640,000	6,278,700	874,951	7,119,256

NOTES: (1) NSF administrative costs are for handling interagency fund transfers related to the shared costs (2) DOS has USGCRP funding but does not participate in Distributed Cost Assessments (3) NASA observations and science; observations reduced by 1/3 for purposes of distributed cost assessment (4) Represents assessment equaling approximately 0.35% of total enacted USGCRP funding for all agencies (5) Agency assessments for FY2011 Distributed Cost Budget Supplemental (FY11 activities) and FY2011 Distributed Cost Budget (FY12 activities) are subject to change pending Congress's approval of FY11 and FY12 President's budgets. *SOURCE: USGCRP National Coordination Office*

U.S. Global Change Research Program

USGCRP National Coordination Office:

The purpose of the U.S. Global Change Research Program (Sec. 101, Public Law 101-606) is to provide for development and coordination of a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.

As per the 2003 USGCRP Strategic Plan¹, "the agencies participating in the USGCRP fund and supervise an interagency office," the USGCRP National Coordination Office (NCO). The NCO provides staffing for the day-to-day coordination of USGCRP-wide development and integration, including:

- Executive Secretariat support for the Subcommittee on Global Change Research (SGCR) of the National Science and Technology Council's (NSTC) Committee on Environment, Natural Resources, and Sustainability (Sec. 102(d), Public Law 101-606);
- Support of interagency working groups responsible for coordinating USGCRP high-priority activities and related program elements (Sec. 102(d), Public Law 101-606);
- Strategic planning, program implementation, and research coordination and integration (Sec. 104, Public Law 101-606);
- Interaction with the National Research Council (Sec. 104(e), Public Law 101-606)
- USGCRP Budget Coordination (Sec. 105, Public Law 101-606);
- Development and coordination of scientific assessment and related the decision support resources (Sec. 106, Public Law 101-606);
- Development and coordination of the Annual Report to Congress, "Our Changing Planet" (Sec. 201, Public Law 101-606);
- Coordination of international cooperation (Sec. 202, Public Law 101-606);
- Development and implementation of an interagency communications plan and management of the Global Change Research Information Office (Sec. 204, Public Law 101-606).

National Research Council:

As Congressionally mandated by the Global Change Research Act of 1990 (Sec. 104(e), Public Law 101-606), the SGCR has an agreement with the National Research Council under which the National Research Council:

- Evaluates the scientific content of the Research Plan; and
- Provides information and advice obtained from United States and international sources, and recommended priorities for future global change research.

Support of International Programs

USGCRP engages with and provides support to International global environmental change programs to meet the Global Change Research Act of 1990 (Sec. 202, Public Law 101-606) requirement for USGCRP to:

- Coordinate U.S. activities with other nations and international global change research activities;
- Promote international, intergovernmental cooperation on global change research;
- Involve scientists and policymakers from developing nations in such cooperative global change research programs; Promote international efforts to provide technical and other assistance to developing nations which will facilitate improvements in their domestic standard of living while minimizing damage to the global or regional environment.

The USGCRP is a leader within a global network of active and engaged international research scientists and institutions. Cooperation and coordination at an international scale, including research, observations, data, and information sharing are critical to advancing understanding of changes in the climate and related systems and

¹ <http://www.globalchange.gov/about/strategic-plan-2003/2003-strategic-plan>

informing our decisions about adaptation, mitigation, and development measures domestically and internationally. The USGCRP, the individual agencies that compose the USGCRP, its various interagency working groups, and, in particular, the Interagency Working Group on International Research and Cooperation interact with a wide range of international research activities that collectively cover the broad spectrum of global environmental change research. International global environmental change programs receiving support from USGCRP include the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP), the World Climate Research Programme (WCRP), DIVERSITAS, the Earth System Science Partnership (ESSP), and the SysTem for Analysis, Research and Training (START).

IPCC Technical Support Unit

The previous administration offered to host Working Group II for the IPCC Fifth Assessment Report (AR5). At the 29th Session of the IPCC (31 August - 4 September 2008, Geneva, Switzerland), the United States Government was elected to assume co-chairmanship of the Working Group II, which entails overseeing development of the Impacts, Adaptation, and Vulnerability volume of the Fifth Assessment Report, as well as hosting the corresponding Technical Support Unit (TSU).

The WG II TSU:

- Coordinates Working Group II activities;
- Provides technical and administrative services in direct support of the co-chairs;
- Provides scientific leadership and direction for the writing teams, communication and implementation of expert nomination and selection, meeting planning, document control, expert and Government reviews and report production, ensuring compliance with IPCC Rules and Procedures and according to a schedule that were decided by the IPCC Bureau and Panel;
- Convenes workshops and expert meetings as required;
- Coordinates the development of IPCC Special Report (e.g. "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation");
- Administers the travel fund for support of non-Federal U.S. scientists participating in IPCC workshops and expert meetings for all three of the IPCC WGs and the science and effects panels of the Montreal Protocol.
- Undertakes other tasks as needed to complete the mandated IPCC assessment task.

Q4. *In consultation with the Office of Management and Budget (OMB), please update the Climate Change Science and Climate Change Technology sections of the June 2010 Federal Climate Change Expenditures Report to Congress to incorporate the President's Fiscal Year 2021 [sic] budget request.*

A1. The June 2010 Federal Climate Change Expenditures Report to Congress will be updated later in 2011. OSTP will provide updated funding data to the Committee at that time.

Q4. *You did not transmit Our Changing Planet: The U.S. Global Change Research Program for Fiscal Year 2011 to Congress until January of this year - some 11 months after the President released his Fiscal Year 2011 Budget.*

a. *Why was this report delayed so long?*

b. *When can we expect to receive Our Changing Planet: The U.S. Global Change Research Program for Fiscal Year 2012?*

A1. Because the USGCRP is undergoing a strategic realignment, additional time was required to develop the FY 2011 edition of the Our Changing Planet report. The FY 2012 edition of Our Changing Report is currently scheduled for release and transmittal to Congress in late summer or early fall of 2011.

Q5. *Over 1.6 billion people - 25 percent of the world's population - do not have access to electricity. Many of them soon will, thanks to expanded use of coal, which is forecast to increase 50 percent by 2030. The affordable electricity provided by coal will enable economic development and help alleviate poverty in places such as China, India, and Africa.*

a. *How will U.S. efforts to reduce greenhouse gas emissions have any impact on climate change given the expected dramatic increases globally? Should the U.S. impose higher energy costs on its citizens if the benefits are negligible?*

b. *You have often said that we must reduce greenhouse gas emissions to avoid climate change-caused "suffering," but won't forcing developing countries to avoid expanded fossil fuel use (or pay more for fossil fuels via carbon capture and sequestration, etc.) serve to prolong global suffering and poverty?*

A1. In its 2010 International Energy Outlook, DOE's Energy Information Administration (EIA) projected that world coal consumption would increase to about 186 quadrillion BTU (quads) in 2030, which is 30 percent greater than 2009 consumption of 143 quads. A single country-China-accounts for 80 percent of the world increase in coal consumption. Almost none of the increase in Chinese coal consumption will go to providing basic access to electricity, because over 99 percent of Chinese households already have access to electricity.

Access to electricity and to the services it provides, such as lighting and refrigeration, is vital to economic development. But in many countries coal appears to be the most "affordable" source of electricity only because many of the costs of coal use-air pollution, acid deposition, and climate change-are not included in the price. In 2007, the World Bank estimated that air pollution, largely from coal burning, was responsible for 350,000 to 400,000 premature deaths per year in China. In 2003, a joint study by the Chinese Institute of Environmental Science and Qinghua University estimated that acid rain from coal burning caused economic losses of over \$13 billion per year. In 2010, an interagency working group estimated that \$5 to \$65 in economic damages results from each additional ton of carbon dioxide emitted (e.g., lost agricultural productivity, human health, property damages from increased flood risk due to climate change), equal to about \$12 to \$160 per ton of coal burned. These damages to human health, economic productivity, and ecosystems from air pollution, acid deposition, and climate change are not included in the price of coal. When a full accounting of the costs is done, cleaner sources of electricity, such as natural gas and renewables, provide greater overall benefits to citizens.

The EIA scenario discussed above, in which coal consumption increases by 30 percent by 2030, does not include policy actions designed to reduce emissions of greenhouse gases. Policy actions by China, India, and other major emitters will be required to reduce global emissions and limit climate change. The United States cannot do it alone, but the United States should and must lead. Reductions in U.S. emissions are essential as part of a strategy to achieve reductions in global emissions, because other major emitters will not act in the absence of tangible action by the U.S., which is the world's largest economy. In addition to the direct health and environmental benefits of our own emission reductions, there will be the larger effect of global emissions reductions that can be spurred by our willingness to act, as well as the economic benefits of leading the world in the development and deployment of clean and efficient energy technology. As the President has said many

times, “The nation that leads the clean energy economy will be the nation that leads the global economy.”

The Administration is not proposing to “force” developing countries to avoid expanded fossil fuel use. Rather, the Administration is attempting to persuade other countries that 3 policies that reduce greenhouse gas emissions are in their own long-term interests, as well as in the common interest of humanity. As noted above, the long-term economic benefits of moving to cleaner sources of energy, such as efficient natural gas and renewables, are greater than the long-term benefits of expanded use of coal without modern pollution controls and carbon capture and sequestration. The short-term economic gains from burning more coal with old technology will be offset by premature deaths due to increased air pollution and by economic damage due to acid rain and climate change.

Q6. *A couple of years ago, a group of well-respected economists, led by Dr. Bjorn Lomborg, prioritized a number of global challenges to determine the most cost-effective way to improve the quality of life for people around the world. Recognizing that we have limited resources, they ranked the value of addressing problems such as disease, malnutrition, climate change, health care, sanitation, and water quality. Compared against these other challenges, climate change came in last - signaling that spending billions to address it would have the lowest impact for the highest cost.*

- a. *Do you believe it makes sense to undertake an economic exercise such as this to inform policymaking?*
- b. *Do you disagree with the group’s conclusions that our money would be better spent fighting disease and addressing water quality issues than trying to impact global climate through CO2 reductions?*

A1. In connection with the Lomborg exercise mentioned, which took place in 2004, I would note that (a) Lomborg is not an economist, (b) the group he convened did no formal and consistent analysis of costs and benefits of the various proposals that were examined, but simply lumped the proposals into four categories based on the personal impressions of the participants after brief discussion of some non-peer-reviewed background papers prepared for the purpose, and (c) Lomborg himself has since changed his view and now advocates large investments in R&D to develop new energy technologies to abate the climate-change threat.

Estimates of costs and benefits are an important guide to policymaking. In a recent Executive Order on Improving Regulation and Regulatory Review (E.O. 13563, January 18, 2011), the President required that agencies “propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs, and that agencies “select, in choosing among alternative regulatory approaches, those approaches that that maximize net benefits.” But the Executive Order also recognizes that costs and benefits can sometimes be difficult to quantify. I believe it is important to carefully consider all of the potential future costs and benefits of proposed policies.

The test of a policy is whether the benefits justify the costs, and whether the policy is designed to achieve the greatest net benefit among feasible alternatives-not whether one can find another policy that has greater benefits per dollar spent. For example, guardrails may save more lives per dollar spent than further safety measures such as seatbelts and airbags, but even given the existence of guardrails, seatbelts and airbags have very high net benefits. Although it is true that public policies should consider existing measures, such as guardrails, when considering adopting other safety measures, in this case we are clearly better off with all three.

The costs and benefits of reducing greenhouse gases are difficult to quantify. This is due to the combined effect of uncertainties in future emissions and greenhouse gas concentrations; uncertainties in the response of the climate system to increased greenhouse gas concentrations; uncertainties in the cost to adapt to these changes in climate and to adopt technologies that reduce emissions; and uncertainties in the monetary value of climate impacts, particularly those far in the future, and those that have no obvious market value, such as the extinction of species. As a result, estimates of the social cost of carbon span a wide range. In 2010, an interagency working group led by the Executive Office of the President estimated that \$5 to \$65 (in 2007 dollars) in economic damages results from each additional ton of carbon dioxide emitted that year (e.g., lost agricultural productivity, human health, property damages from increased flood risk due to climate change). This means that it would be economically beneficial to spend at least \$5 per ton, and as much as \$65 per ton, to reduce carbon dioxide emissions. The working group also estimated these values would increase over time as the magnitude of climate change increases, reaching approximately \$16 to \$136 per ton (in 2007 dollars) by 2050. Even taking the lower

values, there are many actions that can be taken to significantly reduce greenhouse gas emissions, in the United States and other countries, that cost less than \$5 per ton, and many more that cost less than \$65 per ton.

Q7. *In testimony before Congress shortly after the ClimateGate scandal broke in December 2009, you characterized the controversy as something that would be “sorted out over time, by the process of peer review.” I am concerned, however, about the integrity of the peer review process itself. The ClimateGate emails revealed a strong pattern of scientists suppressing scientific information that does not conform to their alarmist viewpoints. For example:*

- a. *Several emails discuss attempts to blacklist certain researchers’ papers from publication, and initiating a boycott of scientific journals that publish papers skeptical of the alarmists’ viewpoints;*
- b. *Other emails discuss ousting editorial board members with non-conforming views; and*
- c. *Perhaps most disturbing, one researcher commits himself to ensuring that no non-conforming science is included in the report of the Intergovernmental Panel on Climate Change (IPCC). Specifically, this researcher said “Kevin and I will keep them out somehow—even if we have to redefine what the peer-review literature is!”*

Please provide your opinion on the appropriateness of these specific emails, specifically whether you agree that they reveal an attempt by leading influential scientists to undermine the peer review process. How does this correspondence impact on your confidence in the peer review process to “sort out” scientific controversies as you stated in earlier Congressional testimony?

A1. The point I was making in my testimony is that scientific controversies—such as the controversy about the validity of the “hockey stick” representation of the temperature history of the Earth over the past two millennia, which was the focus of most of the stolen emails—generally get sorted out over time by the process of peer review and continued critical scrutiny by the knowledgeable community of scientists. Nothing in the e-mails shakes my confidence in the validity of this contention. Scientists, like other human beings, sometimes make mistakes in their work, and, like other human beings, in the midst of controversy and the heat of debate they sometimes say ill-considered things. But peer review and continuing discussion in the community of the knowledgeable is an excellent mechanism—the best we have—for sorting through claims and counter-claims, filtering out the wrong and the irrelevant, and clarifying, over time, what we can say with confidence.

In the case of the “hockey stick” controversy addressed in the stolen e-mails, the matter ended up going to the highest U.S. “court of appeal” in the domain of peer review—the National Academy of Sciences. The Academy’s exhaustive report (National Research Council, *Surface Temperature Reconstructions for the Last 2,000 Years*, National Academy Press, 2006, 156 pp) concluded that the methods of analysis used by the “hockey stick” authors were scientifically acceptable and that the authors’ key conclusion that the last 50 years have been the warmest in many centuries is likely to be correct. And, while in science there is never a “last word”, nothing that has been said or published since the 2006 Academy report has offered a plausible refutation of its conclusions or made a case that the Academy’s review was itself marred by bias.

The stolen e-mails do reveal that some of the scientist authors became frustrated and impatient with queries about their data from critics whose motives they felt were other than the pursuit of knowledge, and frustrated as well by the publication of a transparently flawed critique of their work in a supposedly peer-reviewed journal that had become notorious for publishing flawed work. (When this particular case came to light, in fact, its editor resigned in embarrassment.) Some of their e-mailed comments in this situation were in a circle-the-wagons vein, not properly respectful of the need for transparency with data no matter the perceived stance of the requestors, and some of the comments lent themselves to misinterpretation outside the context in which they were made. But there is nothing in these e-mails that comes close to supporting a case for pervasive corruption in the peerreview system in climate science.

That has also been the conclusion of all five formal reviews of the e-mail flap that I am aware of. Thus, the UK House of Commons report (<http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/387/387i.pdf>) concluded on this point that “Likewise the evidence that we have seen does not suggest that Professor Jones was trying to subvert the peer review process. Academics should not be criticized for making informal comments on academic papers.”

A second UK review, The Scientific Assessment Panel headed by Lord Oxburgh (<http://www.uea.ac.uk/mac/comm/media/press/CRUstatements/SAP>), wrote: "We saw no evidence of any deliberate scientific malpractice in any of the work of the Climatic Research Unit and had it been there we believe that it is likely that we would have detected it. Rather we found a small group of dedicated if slightly disorganized researchers who were illprepared for being the focus of public attention. As with many small research groups their internal procedures were rather informal."

The RA-10 Inquiry Report investigating Professor Michael Mann's actions under Penn State's research misconduct policy concluded as follows: "The Investigatory Committee determined that Dr. Michael E. Mann did not engage in, nor did he participate in, directly or indirectly, any actions that seriously deviated from accepted practices within the academic community for proposing, conducting, or reporting research, or other scholarly activities."

The Independent Climate Change Email Review (<http://www.ccereview.org/pdf/FINAL%20REPORT.pdf>) stated that "On the specific allegations made against the behavior of CRU scientists, we find that their rigor and honesty as scientists are not in doubt... In addition, we do not find that their behavior has prejudiced the balance of advice given to policy makers. In particular, we did not find any evidence of behavior that might undermine the conclusions of the IPCC assessments."

Most recently, last month's Report of the Inspector General of the Department of Commerce, on whether the e-mails pointed to any wrongdoing by NOAA scientists, found as follows (<http://www.oig.doc.gov/oig/reports/2011/001688.html>): "In our review of the CRU emails, we did not find any evidence that NOAA inappropriately manipulated data comprising the GHCN-M [Monthly Global Historical Climatology Network] dataset or failed to adhere to appropriate peer review procedures."

With regard to "blacklisting," "boycotting," and "ousting," please see the discussion in Chapter 8 of The Independent Climate Change Email Review, beginning on page 68 (<http://www.cce-review.org/pdf/FINAL%20REPORT.pdf>). The Review concludes: "In our judgment none of the above instances represents subversion of the peer review process nor unreasonable attempts to influence the editorial policy of journals. It might be thought that this reflects a pattern of behavior that is partial and aggressive, but we think it more plausible that it reflects the rough and tumble of interaction in an area of science that has become heavily contested and where strongly opposed and aggressively expressed positions have been taken up on both sides. The evidence from an editor of a journal in an often strongly contested area such as medicine (Appendix 5) suggests that such instances are common and that they do not in general threaten the integrity of peer review or publication."

Q8. The centerpiece proposal in President Obama's State of the Union address is his plan to require 80 percent of U.S. electricity to be derived from "clean" energy sources. A study by economists at Suffolk University found that the cost of a clean energy standard similar to what the President is proposing would be almost \$200 billion a year and over \$4 trillion over a 20-year period. Other studies might estimate these figures to be higher or lower, but as a matter of basic economics, doesn't the President's proposal amount to mandating Americans to pay significantly higher electricity costs? If the President's plan is successfully implemented, and we do indeed achieve his 80 percent clean energy goal, how much will projected climate threats be reduced?

A1. The Suffolk University study focuses on a renewable portfolio standard (RPS). Unlike the President's proposal, an RPS does not include natural gas, nuclear, and coal with carbon capture and sequestration as sources that qualify towards meeting the target. The omission of natural gas from an RPS is particularly significant because natural gas is an abundant low-cost resource and because generation can be increased substantially at existing gasfired plants, in addition to building new plants. Even if the Suffolk University study had correctly assessed the impacts of an RPS, which I do not believe to be the case, the results would not apply to the President's clean energy proposal.

While the President's proposal is not an RPS, other available analyses of an RPS, including several studies conducted by the Energy Information Administration at the request of both House and Senate Committees, estimated much smaller effects of an RPS on electricity prices and consumer expenditures.

The President's clean energy proposal is not a mandate for higher electricity costs. The implications for electricity prices will depend on the specific details of the program, which have not yet been determined, but it is possible that electricity prices over the next decade would be reduced as generators using efficient natural gas plants would have an incentive to increase electricity generation. The long-run effect of the clean energy goal on electricity prices would depend significantly on the cost

of various clean generation technologies in the future, and that is why it is important to reduce the costs of clean energy by accelerating the pace of innovation through research and development. In addition to the price of electricity, one must take into account the health and other economic and environmental benefits associated with reduced air pollution and climate impacts that result from using cleaner sources of energy.

Electricity generation currently accounts for about one-third of U.S. greenhouse gas emissions, and nearly 40 percent of net U.S. emissions after accounting for land use and land-use change. A program that substantially reduces emissions associated with electricity generation would significantly reduce U.S. emissions. Policy actions by China, India, and other major emitters will be required to reduce global emissions and limit climate change. The United States cannot do it alone, but the United States should and must lead. Reductions in U.S. emissions are essential as part of a strategy to achieve reductions in global emissions, because other major emitters will not act in the absence of tangible action by the U.S., which is the world's largest economy. In addition to the direct health and environmental benefits of our own emissions reductions, there will be the larger effect of global emissions reductions that can be spurred by our willingness to act, as well as the economic benefits of leading the world in the development and deployment of clean and efficient energy technology. As the President has said many times, "The nation that leads the clean energy economy will be the nation that leads the global economy."

Q9. You testify that you will soon be convening a new National Science and Technology Council STEM Education Committee. Please describe how you envision this Committee identifying duplicative and ineffective STEM programs across the federal government and what actions will be taken to save the American taxpayer from continuing to support these programs? Similarly, how will this Committee work to replicate or promote successful programs?

A1. STEM education itself is a very broad topic. It encompasses instructional activities that target the earliest years of school through adulthood, covers a large range of subjects and enormous variations in the depth of learning desired, varies with geography and local cultures and socio-economic conditions, involves a host of public and private enterprises, and involves a range of formal and informal educational settings. Because of the span and complexity of STEM education, it is appropriate that there are numerous and diverse programs devoted to it across a number of Federal entities. But there may well be some overlap and duplication, and the newly convened NSTC Committee on STEM Education will be examining this issue as called for in the America Competes Reauthorization Act of 2010.

The first step in this process will be to appropriately characterize the numerous existing STEM education programs. A detailed classification of programs, once complete, will then allow us to determine appropriate methods and standards for evaluation to determine the effectiveness of a given program. We will work with OMB and the agencies to find suitable cost-effective ways to examine the effectiveness of the programs, and to find how their effectiveness can be improved.

Q9. You testify that the Administration plans to invest \$3.4 billion across the federal government for STEM education, including many new initiatives primarily at the Department of Education. While the Department of Education should certainly take a more active role in STEM, what is the rationale for shifting support from NSF to Education? How actively involved can you be, as Director of OSTP, in decisions being made at the Department of Education on STEM-related issues? What steps has the Administration taken to ensure that these new activities are researchbased and will have input from not only the education community but also the scientific community?

A1. Both NSF and the Department of Education can and should play critical roles in STEM education. Budgetary decisions on STEM-education programs are made within the individual agencies. In both NSF and the Department of Education there are multiple programs that are proposed for increases or decreases in the 2012 Budget in response to changing priorities and evaluations of the impact of existing programs. No explicit decision was made to trade off funds in one agency for funds in the other. Each agency has its particular mandates and strengths. The new Committee on STEM Education, working with the Office of Management and Budget, will work to better coordinate STEM education activities throughout the Federal government, including within NSF and the Department of Education. The importance of utilizing research and evaluation to inform STEM-education efforts is clear to OSTP. OSTP has and will continue to push all federal agencies to develop education efforts based on the latest research in education and scientific disciplines.

Questions submitted by Representative Paul Broun

Q1. *As a follow-up to our conversation regarding Scientific Integrity, please respond to the following:*

- a. *Does your December memo exempt OMB or the White House Offices from the scientific integrity guidelines?*
- b. *Are you familiar with the memo your predecessor developed titled "Principles for the Release of Scientific Research Results"?*
- c. *Please point out how these documents differ.*

Aa. No.

Ab. Yes.

Ac. One important difference is that the "Principles" document from the last Administration focuses on just one aspect of scientific integrity - the public release of scientific research results through the media and other channels. While that subject is covered in my Dec.17 memorandum (in a number of places but primarily in Section II), my memo covers a number of other issues important to scientific integrity, including the use of Federal Advisory Committees, activities relating to the professional development of Federal scientists and engineers, conflicts of interest, and whistleblower protections. My memorandum also explicitly calls upon all covered departments and agencies to craft scientific integrity policies consonant with the guidelines in his memorandum, and imposes a deadline by which time agencies and departments are to report to me on their progress.

Further, with regard to public release of government information, my Memorandum goes further than the last Administration's. It explicitly notes that just telling the "facts" is not enough. Specifically, it insists that government scientists and communicators provide underlying assumptions, contextualization of uncertainties, and descriptions of probabilities associated with optimistic and pessimistic projections, including best-case and worst-case scenarios where appropriate. My memorandum also explicitly states that "in no circumstance may public affairs officers ask or direct Federal scientists to alter scientific findings."

Q2. *With regard to the BP Deepwater Horizon spill, please respond to the following:*

- a. *What was your role in response to the BP Deepwater Horizon spill?*
- b. *Where did OSTP, OMB and Carol Browner fit into the national incident command structure?*
- c. *At any point did you approve or review scientific documents, declarations of peer review, or the release of scientific information from agencies? If so, which documents, declarations, or releases? If not, why were other White House offices like OMB and the Office of Energy and Climate Change Policy involved in doing so, but not OSTP?*
- d. *You have been appointed co-chair of the National Ocean Council—an effort in part to better coordinate the Federal ocean policy and the two dozen or so federal agencies that work and have authority in the ocean. How will this new organizational structure better manage a crisis like the one in the Gulf last year? It appears as if you already had authority and a charter to lead and coordinate federal science response which you did not do with the BP Oil Spill. Will that change?*

A2. As the Assistant to the President for Science and Technology and Director of OSTP, I participated in the Administration's response to the event from the outset, including taking part in the Principals' conference calls and Principals' meetings throughout its course.

In the first days following the explosion, I helped Secretary Chu set up his government / private sector / academic science team focused on the challenge of capping the well. I provided an OSTP expert on deep-water drilling to serve as regular member of that group, and I took part myself in many of the team's intensive, multi-hour conference calls over the months culminating in the capping of the well.

Also in the first days following the explosion, I and OSTP Associate Director for Environment Shere Abbott started reaching out to leaders in the ocean-science community both inside and outside the government to help create connections among them to ensure that as much as possible of the country's relevant expertise on understanding and mitigating the effects of oil in the oceans was brought to bear. Inside the Executive Branch, Ms. Abbott and I initiated interagency discussions involving NOAA, EPA, USGS, DOE, DHS, and FDA to identify S&T needs and capabilities for the response and recovery efforts and the longer-term concerns of restoration.

With respect to the short-term issues, it was clear that agencies needed to work together to quantify oil, gas, and dispersant volumes; understand and forecast the fate of surface and subsurface oil and dispersants; assess ecosystem impacts, including seafood safety; and evaluate mitigation measures. To address these short-term needs, OSTP worked together alongside other offices of the Executive Office of the President and the relevant Federal departments and agencies to establish action teams that immediately began working on analyzing the oil flow rate, the fate of oil in the water column and at the surface, dispersant use and its impacts, measurements and monitoring, coastal impacts and mitigation, seafood impacts and mitigation, and rapid assessment of mitigation technologies. OSTP also helped to foster the creation of the interagency Joint Analysis Group to provide rapid analyses of emerging data to guide real-time response, and OSTP's experts were mainstays of that group's work throughout the duration of the spill and continuing into the recovery and restoration phases.

OSTP's outreach to the nongovernmental community of expertise, meanwhile, was ultimately broadened and formalized in a series of national workshops bringing together the directors and research leaders from marine science centers around the country with experts from the relevant Federal departments and agencies. With Associate Director Abbott and USGS Director Marcia McNutt, I co-convened the first of these national meetings at EPA headquarters on May 19, attended by 30 leaders of the nongovernmental research community and 30 government officials including Secretary Salazar, Administrator Jackson, and Assistant Secretary Robinson of NOAA. One result of that meeting was a decision by NOAA, NSF, and EPA to expedite funding to universities for critical research in the Gulf of Mexico. Numerous follow-on meetings covering topics such as coastal and ocean impacts and dispersants took place in the Gulf region, hosted by NOAA, NSF, and EPA, with OSTP assistance and participation.

In May 2010, OSTP also began to work on longer-term research needs including: the impacts of dispersants on the marine ecosystem; monitoring programs for the coasts and deepwater; the fate and impacts of oil on deepwater ecosystems; and the development of new clean-up technologies. We engaged the National Science and Technology Council's Subcommittee on Ocean Science and Technology (SOST) to begin interagency work on many of these issues. SOST organized and executed a workshop in early October for scientific investigators to discuss early results of their work and catalyze efficient and productive collaborations.

For long-term recovery needs, OSTP provided input to Secretary Mabus' report, *America's Gulf Coast—A Long Term Recovery Plan*, that lays the foundation for the current work of the President's Gulf Coast Restoration Task Force. OSTP's Associate Director for Environment serves on this Task Force, and our Assistant Director for Ocean Sciences serves on its Science Coordination Team. OSTP contributed to Secretary Mabus' plan, particularly in its recommendation that restoration activities be firmly based in sound science.

Carol Browner, Assistant to the President for Energy and Climate Change, operated as the EOP coordinator of activities related to the oil spill. I reported regularly to her on OSTP's activities in bringing relevant S&T expertise to bear, and also participated in Principals' meetings on the subject.

The Office of Management and Budget (OMB) established a procedure for coordinated review of information related to the oil spill from the EOP and Federal agencies. OSTP participated in these OMB-coordinated reviews. The President's July Executive Order establishing a new National Ocean Policy and cabinet-level National Oceans Council, which I co-lead with CEQ Chair Nancy Sutley, has put in place a framework for coordination and interaction among responsible Federal entities and stakeholders in state and local governments, tribal authorities, the private sector, and NGOs that, among many other benefits, will facilitate the coordinated responses that events like the Gulf oil spill require. The Policy's focus on strengthening the marine science knowledge base and monitoring capabilities will also increase the national capacity to cope with and recover from future oil spills as well as other events impacting our oceans and coastlines.

Q3. *With regard to the Gulf Coast Research Initiative, please respond to the following:*

- a. *What was your role in working with BP on the independent Gulf Research Initiative, which set aside \$500 million for scientific research?*
- b. *When did you first hear of it?*
- c. *What was the funding mechanism they were considering?*

- d. BP was ready to release a RFP on June 15 - but later stated they were directed by the White House to work with the Gulf Governors. (see White House Fact Sheet, June 16, 2010). Were you a party to those discussions?
- e. Under what authority did the White House direct the GRI to work with Governors?
- f. When did you learn of the plan to delay the RFP to work with the Governors?
- g. Did you think was a good idea?
- h. You had to expect a delay - which would mean that critical research and data could be missed while negotiating with the governors. As his Science Advisor, did you brief the President on how this delay would impact science?
- i. Only around \$40-\$50 million has been released so far, and at an 8 month delay. Were the awards included in that \$40-\$50 million peer reviewed?
- j. Would proposals have been peer reviewed under the system in place before White House intervention?
- k. What are the benefits of working with the Governors?
- l. Do they outweigh this delay?
- m. Would you characterize this as a slush fund?

A3. The Gulf Coast Research Initiative (GRI) is a program led and administered by BP. I learned of BP's interest in supporting a long-term scientific research program associated with the oil spill in mid-May, 2010, when staff from OSTP and the Departments of Commerce and Interior met with BP officials following the OSTP-led forum at EPA on "Scientific Research on the Effects and Fates of Oil in the Ocean". At the post-forum meeting, BP's chief scientist described what the company had in mind for the GRI, which was to provide \$500 million over a 10-year period to create a broad independent research program that would investigate the impacts of the oil and dispersant on the ecosystems of the Gulf of Mexico and affected coastal States. My government colleagues and I were welcoming of this BP initiative.

Questions submitted by Representative Marcia L. Fudge

- Q1. *Last Congress, I introduced an amendment to COMPETES that would direct NSF and Department of Education to collaborate and identify the grand challenges facing research and development in STEM education teaching and learning. Specifically, it aimed to address how we can scale successful programs, increase teacher effectiveness, broaden participation, and understand the role of cyber-enabled teaching tools. This amendment also required the agencies to solicit input from stakeholders in the STEM community.*
- Q2. *I am pleased to see that OSTP is in the process of establishing an interagency STEM education committee. Could you please describe how the committee plans to solicit input from all the various STEM education stakeholders, and also address the challenges I just listed, especially the need to improve coordination on STEM education research?*

A. The Committee on STEM Education is very sensitive to the importance of all of these factors and the need to obtain input from stakeholders. The Committee recently met for the first time (on March 4, 2011). It is now in the process of formulating plans for how to achieve these goals.

Questions submitted by Representative Ben R. Lujan

Regional Innovation Clusters:

Thank you for your commitment to job creation and making America a leader in technology and innovation. As you know, the America COMPETES Act authorized the Regional Innovation Program to promote regional innovation clusters. Research parks have the capability of bringing together students, entrepreneurs, scientists and engineers and other key innovators to support cutting edge research and development activities. My home state of New Mexico, for example, is currently engaged in science park activities at Los Alamos Research Park, the Sandia Science and Technology Park and the University of New Mexico Science and Technology Park. I believe these parks can serve as a basis for forming an innovation cluster.

- Q1. *The President's FY12 Budget Request requests \$40 million for this program, \$60 million less than the authorization amount. Can you discuss in more detail the*

Administration's vision for implementation of this program, especially considering the scaled-back funding request?

A1. The Department of Commerce's Economic Development Administration (EDA) will implement the Regional Innovation Program. EDA's vision for implementing this program follows:

Regional Innovation Program:

Base Funding: \$0.0 million; Program Change: + \$40.0 million. EDA requests an increase of \$40.0 million for a total of \$40.0 million to fund the new Regional Innovation Program to foster collaboration across the Federal government to build regional innovation clusters based upon the inherent strengths of a community.

Proposed Actions:

The "America COMPETES Reauthorization Act of 2010" will help advance the President's vision by encouraging innovation that builds capacity for regions to improve and advance toward the future. This Act created the new Regional Innovation Program, which will be implemented by EDA, to build upon the understanding that robust regional innovation cluster strategies create a blueprint for improving the conditions or "ecosystem" in which innovation companies and entrepreneurs can accelerate the development of new businesses, products or services.

In FY 2012, under this new Regional Innovation Program, EDA will implement a Growth Zones initiative. The Growth Zones initiative will provide strategic investments to help communities leverage their innovation ecosystems to create jobs, businesses, and regional prosperity. Specifically, the program will support a nationwide competition to encourage 20 communities to develop and implement regional strategic plans that identify how the community can build on assets and link to drivers of regional economic growth in order to stimulate job creation, business expansion and creation, and enhanced regional prosperity.

Statement of Need and Economic Benefits:

In his State of the Union Address the President stated, "We need to out-innovate, out-educate, and out-build the rest of the world. We have to make America the best place on Earth to do business. We need to take responsibility for our deficit and reform our government. That's how our people will prosper. That's how we'll win the future."

The Obama Administration is responding by embracing more flexible and innovative policies and by launching strategic initiatives that will achieve smarter utilization of existing federal resources. For example, EDA launched its Jobs and Innovation Partnership to stimulate innovation and collaboration, which are key drivers of regional economic development. EDA's Regional Innovation Program (Growth Zones) will further advance the Jobs and Innovation Partnership by providing strategic investments to help communities leverage their innovation ecosystems to create jobs, businesses, and regional prosperity. In short, through the Regional Innovation Program EDA will support investments that will help communities mitigate the impact of the recent fiscal downturn and accelerate the transition toward a more prosperous economy. This need is particularly acute given the current fiscal crisis and the national jobs and growth outlook.

Base Resource Assessment:

In FY 2012, this program will be specifically targeted to support Growth Zones, a collaborative, multi-agency effort to stimulate regional economic development. Specifically, the program will support a nationwide competition to encourage 20 communities to develop and implement regional strategic plans that identify how the community can build on assets and link to drivers of regional economic growth in order to stimulate job creation, business expansion and creation, and enhanced regional prosperity.

Schedule & Milestones:

FY 2012-2016

Creation of Regional Innovation Program (Growth Zones) Expansion of inter-Agency collaboration related to Regional Innovation Clusters

Deliverables:

FY 2012-2016

Strategic investments that can support globally competitive regions, promote regional innovation clusters, and encourage 21st Century innovation infrastructure; and, increasing focus on collaborative funding with other Federal agencies to leverage federal grant funds, support regional innovation clusters, and contribute to sustainable economic development.”

Q2. Minorities in STEM The recent National Academy of Sciences report Expanding Underrepresented Minority Participation: America’s Science and Technology Talent at the Crossroads makes clear that we must continue our efforts to increase minority participation in STEM. In 2007, underrepresented minorities comprised 33.2% of the U.S. college age population, and 26.2% of undergraduate enrollment, yet only 17.7% of those were earning science and engineering bachelor’s degrees. As OSTP moves forward with its new interagency STEM committee to coordinate federal STEM education programs, how will the committee ensure that this important challenge is addressed?

A. Broadening participation is certainly a primary goal of the new Committee on STEM Education. The two separate, yet both very important, issues relating to these statistics are: First, the quality of preparation of underrepresented minorities in K-12 for college and careers; and second, retaining underrepresented minority students who enter college as STEM majors in those majors. The Committee will look closely at the level and quality of investment in programs that address these issues, as well as exploring ideas for how to do better.

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