THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY: EXAMINING PRIORITIES AND EFFECTIVENESS OF THE NATION'S SCIENCE POLICIES

HEARING

BEFORE THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

WEDNESDAY, JUNE 20, 2012

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THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY: EXAMINING PRIORITIES AND EFFECTIVENESS OF THE NATION'S SCIENCE POLICIES

WEDNESDAY, JUNE 20, 2012

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

The Committee met, pursuant to call, at 10:00 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
2321 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-6301
(202) 225-6371
www.science.house.gov

Full Committee Hearing

The Office of Science and Technology Policy: Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m. to 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

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

HEARING CHARTER

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Wednesday, June 20, 2012, the Committee on Science, Space, and Technology will hold a hearing to exercise the Committee's oversight authority of the Office of Science and Technology Policy (OSTP) by examining its roles, responsibilities, operations and management and its function in shaping our national science policy.

2. Witness

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

3. Overview

- The National Science and Technology Policy, Organization, and Priorities Act of 1976 (P.L. 94-282) established in law the Office of Science and Technology Policy (OSTP). The primary purposes of the statute were "to establish a science and technology policy for the United States, to provide for scientific and technological advice and assistance to the President, to provide a comprehensive survey of ways and means for improving the Federal effort in scientific research and information handling, and in the use thereof."

- The Fiscal Year (FY13) Budget Request for OSTP is $5.85 million, $1.35 million (23 percent) above the FY12 appropriated amount. Currently, both the House and Senate Commerce, Justice, Science and Related Agencies Appropriations measures fully fund OSTP at the requested level.

- "The primary function of the [OSTP] Director is to provide, within the Executive Office of the President, advice on the scientific, engineering, and technological aspects of issues that require attention at the highest level of Government....The Office shall serve as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government."

- The Assistant to the President for Science and Technology serves as a Member of the National Science and Technology Council (NSTC). The NSTC was established by Executive Order 12881 in 1993 and is comprised of the President, Vice President, Cabinet Secretaries and Agency Heads with significant science and technology responsibilities. OSTP provides support for the NSTC.[1]

- The Assistant to the President for Science and Technology serves as a Co-Chair of the President's Council of Advisors on Science and Technology (PCAST). The current PCAST was established by Executive Order 13539 in 2010. Historically, OSTP has provided funding, administrative, and technical support to PCAST. Executive Order 13596, signed in December 2011, transferred these responsibilities to the Department of Energy.

- In February 2012, the Congressional Research Service (CRS) updated CRS Report RL34736, *The President's Office of Science and Technology Policy (OSTP): Issues for Congress*. In addition to providing an overview of OSTP, the report addresses various issues and options for Congress to consider.

4. Background

Historical Perspective[2]

Throughout U.S. history, Presidents have chosen a variety of informal and formal methods to solicit science and technology advice. Trusted personal sources, advisory boards, and committees filled these roles for decades. Absent a statute in place, often these boards and committees would be disbanded or reorganized based on the needs of the President in office.

As World War II approached and the importance of research and development to our economic and military strength became more obvious, President Roosevelt established, through Executive Order, the Office of Scientific Research and Development (OSRD). The work of OSRD, under the leadership of Vannevar Bush, essentially provided the foundation for current U.S. science and technology policy by emphasizing the importance of science and technology to the Nation's economy and national security.

President Eisenhower created, within the Executive Office of the President, an Office of the Special Assistant to the President for Science and Technology. Presidents Kennedy and Johnson followed with the Office of Science and Technology (OST). President Nixon abolished OST, putting its civilian functions under the National Science Foundation and its security functions under the National Security Council. In addition, Nixon also abolished the President's Science Advisory Committee (PSAC), the external advisory group used by Eisenhower, Kennedy, and Johnson.

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[1] *Fiscal Year 2013 Appendix Budget of the U.S. Government*, p. 1214.
[2] CRS Report RL34736, *The President's Office of Science and Technology Policy (OSTP): Issues for Congress*. John F. Sargent, Jr., and Dana A. Shea, p. 1-3.

President Ford supported the return of a formal science advisory mechanism to the White House through statute versus Executive Order, leading to the creation of the current Office of Science and Technology Policy (OSTP).

Office of Science and Technology Policy (OSTP)

The National Science and Technology Policy, Organization, and Priorities Act of 1976 (P.L. 94-282) established in law the Office of Science and Technology Policy (OSTP), the position of OSTP Director, and the President's Committee on Science and Technology (PCST).[3] The House Committee on Science and Technology was instrumental in the passage of this Act. While the Director of OSTP has appeared before this Committee on numerous occasions throughout the years, it has primarily been for budget hearings or specific to a particular topic. The Committee has not held a hearing specific to the general oversight of OSTP since the adoption of this Act.

The statute states that OSTP "shall serve as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government."[4] The primary function of the OSTP Director, who is appointed by the President with the advice and consent of the Senate, is to provide "advice on the scientific, engineering, and technological aspects of issues that require attention at the highest levels of Government" and:

1) Advise the President of scientific and technological considerations involved in areas of national concern including, but not limited to, the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources;
2) Evaluate the scale, quality, and effectiveness of the Federal effort in science and technology and advise on appropriate actions;
3) Advise the President on scientific and technological considerations with regard to the Federal budgets, assist the Office of Management and Budget with an annual review and analysis of funding proposed for research and development in budgets of all Federal agencies, and aid the Office of Management and Budget and the agencies throughout the budget development process; and
4) Assist the President in providing general leadership and coordination of the research and development programs of the Federal government.[5]

Currently, OSTP defines its mission as being threefold: "first, to provide the President and his senior staff with accurate, relevant, and timely scientific and technical advice on all matters of consequence; second, to ensure that the policies of the Executive Branch are informed by sound science; and third, to ensure that the scientific and technical work of the Executive Branch is properly coordinated so as to provide the greatest benefit to society."[6]

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[3] PCST is the forerunner to the current PCAST.
[4] P.L. 94-282 Section 205 (a)
[5] Ibid. Section 204 (a) and (b)
[6] http://www.whitehouse.gov/administration/eop/ostp/about

OSTP outlines its strategic goals and objectives as follows:

- Ensure that Federal investment in science and technology is making the greatest possible contribution to economic prosperity, public health, environmental quality, and national security;
- Energize and nurture the processes by which government programs in science and technology are resourced, evaluated, and coordinated;
- Sustain the core professional and scientific relationships with government officials, academics, and industry representatives that are required to understand the depth and breadth of the Nation's scientific and technical enterprise, evaluate scientific advances, and identify potential policy proposals; and
- Generate a core workforce of world-class expertise capable of providing policy-relevant advice, analysis, and judgment for the President and his senior staff regarding the scientific and technical aspects of the major policies, plans, and programs of the Federal government.[7]

In addition to a Director, the statute authorizes up to four Associate Directors, also appointed by the President and with the advice and consent of the Senate. Currently, OSTP has no Senate confirmed Associate Directors, but is operating with four fully staffed divisions: Environment and Energy, National Security and International Affairs, Science, and Technology.

Environment and Energy Division[8]
The current Administration and OSTP view "climate change, sustainable development, and the need to foster new and cleaner sources of energy" as the most pressing issue facing the nation. OSTP goals for addressing this issue include:

- Reducing greenhouse gas emissions 80 percent below 1990 levels by 2050;
- Implementing a market-based cap-and-trade system;
- Establishing a national low carbon standard;
- Doubling fuel economy standards within 18 years and get 1 million plug-in hybrid cars on the road by 2015;
- Demanding that federal government use renewable sources of electricity and making federal building "zero-emission" by 2025;
- Reducing dependence on foreign energy sources;
- Promulgating policies that make the U.S. a leader in marine stewardship;
- Creating millions of new green jobs;
- Strictly monitoring and regulating pollution from large Concentrated Animal Feeding Operations;
- Protecting the public from nuclear material; and
- Encouraging organic and sustainable agriculture.

National Security and International Affairs Division[9]
OSTP's Organic Act includes provisions for OSTP to "assess and advise on policies for international cooperation in science and technology which will advance the national and

[7] Ibid.
[8] http://www.whitehouse.gov/administration/eop/ostp/divisions/energyenvironment
[9] http://www.whitehouse.gov/adminsitration/eop/ostp/divisions/natsecintaff

international objectives of the United States" and to "identify and assess emerging and future areas in which science and technology can be used effectively in addressing national and international problems."[10]

The current Administration and OSTP have identified bio-terror, cyber-sabotage, and avian flu as a few natural and manmade threats facing the U.S. OSTP goals for assessing and addressing these types of issues include increasing funding for defense, homeland security, and intelligence agencies in the areas of basic and applied research and development; building a stronger and more productive cybersecurity research program; and strengthening U.S. intelligence collection to be more pro-active rather than reactive in identifying bioterrorist threats.

Nuclear goals include:

- Securing all loose nuclear materials in the world within four years;
- Strengthening the Nuclear Non-Proliferation Treaty; and
- Achieving the goal of eliminating nuclear weapons worldwide.

Science Division[11]

The current Administration and OSTP's vision for science in America include:

- Dramatic increases in funding for biomedical research and the physical sciences and engineering;
- Increased support for high-risk/high-payoff research that has the most potential to produce real breakthroughs;
- Making the R&D tax credit permanent while eliminating all capital gains taxes on start-up and small businesses;
- Ensuring that all Americans have the science, technology, engineering and mathematics (STEM) education they need to participate in modern society.

Technology Division[12]

The current Administration and OSTP's plan to advance comprehensive technology and innovation include:

- Connecting Americans to a modern broadband communications infrastructure;
- Lowering health care costs by advancing health IT;
- Modernizing public safety communications;
- Upgrading education to meet the needs of the 21st century;
- Developing new clean energy sources; and
- Developing next generation manufacturing technologies.

The Fiscal Year (FY13) Budget Request for OSTP is $5.85 million, $1.35 million (23 percent) above the FY12 appropriated amount.[13] Currently, both the House and Senate FY13 Commerce,

[10] P.L. 94-282 Section 205 (a) (9) and (10)
[11] http://www.whitehouse.gov/administration/eop/ostp/divisions/science
[12] http://www.whitehouse.gov/administration/eop/ostp/divisions/technology
[13] FY12 Appropriations for OSTP were $4.5 million, or 32.3 percent below the FY11 level, due to Apropriator's concern over OSTP activities with China.

Justice, Science and Related Agencies Appropriations measures fully fund OSTP at the requested level.

National Science and Technology Council (NSTC)

The National Science and Technology Council (NSTC) was established by Executive Order 12881 in 1993. According to the NSTC website, "This Cabinet-level Council is the principal means within the executive branch to coordinate science and technology policy across the diverse entities that make up the Federal research and development enterprise."[14]

The functions of the Council are:

- To coordinate the science and technology policy-making process;
- To ensure science and technology policy decisions and programs are consistent with the President's stated goals;
- To help integrate the President's science and technology policy agenda across the Federal Government;
- To ensure science and technology are considered in development and implementation of Federal policies and programs; and
- To further international cooperation in science and technology.[15]

The Council recommends to the Office of Management and Budget (OMB) research and development budgets that reflect national goals and provides advice to the OMB Director on agencies' budget submissions.

The Council is comprised of the President, the Vice President, Cabinet Secretaries and Agency Heads with significant science and technology responsibilities. The Assistant to the President for Science and Technology (Assistant) is a Member. The OSTP Director is not a Member, but OSTP provides support for NSTC.

According to the Executive Order, "The President or, upon his direction, the [Assistant] may convene meetings of the Council." The Assistant presides over meetings of the Council in the absence of the President or Vice President. "In practice, the NSTC rarely meets with the President or Cabinet-level officials present. Rather, OSTP staff and detailees manage NSTC activities in conjunction with federal agency staff."[16]

The Council may function through established or ad hoc committees, task forces, or interagency groups. Currently, the Council has five Committees:

- Environment, Natural Resources, and Sustainability (CENRS)
- Homeland and National Security (CHNS)
- Science (CoS)
- Science, Technology, Engineering, and Math Education (CoSTEM)

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[14] http://www.whitehouse.gov/administration/eop/ostp/nstc

[15] Executive Order 12881

[16] CRS Report RL34736, *The President's Office of Science and Technology Policy (OSTP): Issues for Congress.* John F. Sargent, Jr., and Dana A. Shea, p. 10.

- Technology (CoT)

Executive departments and agencies make resources available to the Council including, but not limited to, personnel, office support, and printing, as requested by the Assistant.

President's Council of Advisors on Science and Technology (PCAST)

The Assistant to the President for Science and Technology (Assistant) serves as a Co-Chair of the President's Council of Advisors on Science and Technology (PCAST). The current PCAST was established by Executive Order 13539 in 2010. "PCAST is an advisory group of the nation's leading scientists and engineers who directly advise the President and the Executive Office of the President. PCAST makes policy recommendations in the many areas where understanding of science, technology, and innovation is key to strengthening our economy and forming policy that works for the American people."[17]

PCAST is comprised of not more than 20 non-federal Members appointed by the President. The President designates one of them to be Co-Chair with the Assistant. Members serve without compensation. PCAST meets regularly to respond to requests from the President or the Assistant for information, analysis, evaluation, or advice on a variety of topics; and to solicit information and ideas for a broad range of stakeholders including the research community, the private sector, universities, national laboratories, state and local governments, foundations, and nonprofit organizations.

PCAST also serves as the advisory committee for the Networking and Information Technology Research and Development program (NITRD) and the National Nanotechnology Initiative (NNI).

Through consultation with the Assistant, PCAST can create standing committees and ad hoc groups such as technical advisory groups to assist it. While PCAST has recently released reports on nanotechnology and undergraduate STEM education, the Advanced Manufacturing Partnership (AMP) is the only active issue on the PCAST website. This partnership is in response to a PCAST Report released in June 2011 on *Ensuring American Leadership in Advanced Manufacturing*. The AMP is a "national effort bringing together the Federal government, industry, universities, and other stakeholders to identify and invest in emerging technologies with the potential to create high-quality domestic manufacturing jobs and enhance the global competitiveness of the United States."[18]

Historically, OSTP has provided funding, administrative, and technical support to PCAST. Executive Order 13596, signed in December 2011, transferred these responsibilities to the Department of Energy.

[17] http://www.whitehouse.gov/administration/eop/ostp/pcast/about
[18] http://www.whitehouse.gov/administration/eop/ostp/pcast/amp

Issues and Options for Congress

In February 2012, the Congressional Research Service (CRS) updated CRS Report RL34736, *The President's Office of Science and Technology Policy (OSTP): Issues for Congress*. In addition to providing an overview of OSTP, the report addresses various issues and options for Congress to consider. Among them are:

Need for science advice within the Executive Office of the President
History has shown that different Presidents prefer different methods of receiving science and technology advice. Does the President require high-level science and technology advice, in what form should this advice come, and what are the legislative and executive branch roles for this function? Does the current OSTP mechanism work?

Compliance of OSTP with statutory restrictions on the use of appropriated funds
Recently, Congressional appropriators sought to restrict OSTP from engaging in certain activities related to China with appropriated funds. OSTP spent a portion of its FY11 appropriations on the activities the appropriators sought to proscribe. OSTP claimed that action infringed upon the President's constitutional authority to conduct foreign diplomacy. The Department of Justice concurred. The Government Accountability Office, however, agreed with the Appropriators that OSTP violated the prohibition on the use of funds. Congress may continue to assert its authority to restrict OSTP activities.

Title, rank, roles, and responsibilities of the OSTP Director
While the roles of the OSTP Director are in statute, to some degree, Presidential discretion dictates the breadth of those roles and responsibilities. The OSTP Director is appointed by the President and confirmed by the Senate. The Assistant to the President for Science and Technology, on the other hand is not, and can claim executive privilege. It is the Assistant to the President that serves on the NSTC and co-Chairs PCAST, not the OSTP Director. Currently, Dr. John P. Holdren holds both titles in the Obama Administration, similar to the practice followed by Presidents Reagan, Bush, and Clinton. Former President George W. Bush only appointed an OSTP Director. No President has ever appointed two separate people to fill these roles. While no individual serving both roles concurrently has ever refused to testify before Congress, there remains the potential for this to occur in the future.

Number and policy foci of OSTP Associate Directors
Statute provides up to four Associate Directors, all requiring Senate confirmation. The previous Administration had two Associate Directors (Science and Technology); the current Administration has four foci areas (Environment and Energy, National Security and International Affairs, Science, and Technology). All of the foci areas are fully staffed, but currently none have a Senate confirmed Associate Director.[19]

[19] Patricia K. Falcone was appointed by President Obama on March 29, 2012, to be Assistant Director for National Security and International Affairs. She is awaiting Senate confirmation. Carl Wieman stepped down as Assistant Director for Science on June 2, 2012.

Funding and staffing levels provided for OSTP

Funding and staffing levels fluctuate for OSTP. OSTP has 40 full-time equivalent (FTE) staff positions. As of February 2012, OSTP had a total of 92 staff members, detailees, fellows, and those on Intergovernmental Personnel Agreement (IPAs): 10 political, 17 career, one consultant, 49 detailees, nine IPAs and six fellows. The number of detailees and fellows per President also fluctuates greatly with 11 during President George H.W. Bush's Administration to 65 in the current Administration.

Participation of OSTP and NSTC in federal agency coordination, priority-setting, and budget allocation

Both OSTP and NSTC participate in federal agency coordination, priority-setting, and budget allocations but at different levels and to varying degrees depending on the particular Administration.

Role of OSTP in ensuring scientific integrity in federally funded and supported research, including the communication of scientific and technical information by federal agency scientists and engineers

On March 9, 2009, the President issued a memorandum on scientific integrity calling on the Director of the office of Science and Technology Policy to develop a plan to ensure "the highest level of integrity in all aspects of the executive branch's involvement with scientific and technological processes" within 120 days.[20] On December 17, 2010, the Director of the Office of Science and Technology policy issued a memorandum on scientific integrity calling on agencies to develop their own plans within 120 days.[21] Efforts to implement scientific integrity principles have been delayed,[22] and concerns have been raised about the thoroughness of Administration directives.[23]

The stature and influence of PCAST

The stature and influence of PCAST also fluctuates at the discretion of the President. A variety of opinions exist on the status and influence of PCAST ranging from a declining stature based on a narrow set of issues not likely to get presidential interest to the need for more issue-focused advisory committees to concern over who should chair the entity.

[20] http://www.whitehouse.gov/the-press-office/memorandum-heads-executive-departments-and-agencies-3-9-09
[21] http://www.whitehouse.gov/sites/default/files/microsites/ostp/scientific-integrity-memo-12172010.pdf
[22] John Holdren, "Scientific Integrity policies Released." Office of Science and Technology Policy Blog, April 6, 2012. Available at: http://www.whitehouse.gov/blog/2012/04/06/scientific-integrity-policies-released
[23] Andrew Wyner, "POGO Questions Scientific Integrity Plans for Contractors and Grantees," Project on Government Oversight, June 1, 2012. Available at: http://pogoblog.typepad.com/pogo/2012/06/pogo-questions-scientific-integrity-plans-for-contractors-and-grantees.html

Chairman HALL. The Committee on Science, Space, and Technology will come to order, and I say good morning, and welcome to today's hearing entitled "The Office of Science and Technology Policy: Examining Priorities and Effectiveness of the Nation's Science Policies."

In front of you are packets containing the written testimony—and thank you for your testimony ahead of time—biography and Truth in Testimony disclosure of today's witness, Dr. John Holdren.

We will have our opening statements, and I will begin with my opening statement.

Dr. Holdren, thank you for joining us today. In your dual role as the President's Science Advisor and as Director of the Office of Science and Technology Policy, you have the President's ear, and that is very important, and as such, you have a real, far-reaching influence on this Administration's direction in science and technology, probably for this Committee, not a more important position on the Hill.

We may not always agree with the advice the Director provides to the President, but science and technology have played a vital role in the making of this Nation and is going to continue to fulfill that role in the future, and as such, I doubt you would find anyone here who would challenge the need for science and need for technology advice in this White House or in any White House. Throughout the history, that advice has come through both informal and formal methods.

The Office of Science and Technology Policy that we know today is a result of the National Science and Technology Policy, Organization, and Priorities Act of 1976, which formally created both the office and established the roles of the Director. The House Committee on Science and Technology was instrumental in the passage of this Act, and it is our responsibility to make sure that the office continues to function in a way that is beneficial to American citizens.

And while Directors historically have joined us annually to review the Administration's budget request and have appeared before us on specific issues from time to time, this is the first time this Committee has met to focus primarily on oversight of OSTP since it was created in statute.

In addition to reviewing its responsibilities, operations, and management, we will also look at its function in shaping our Nation's policies. It should come as no surprise that I remain concerned about a number of this Administration's science and technology policy issues, ranging from an unprecedented emphasis on clean energy at the expense of other priorities to a larger focus on applied research at the expense of basic scientific research to the lack of a clearly identified and compelling long-term mission for human spaceflight. Further, there are other areas still awaiting action from OSTP and the Administration. These include transparency and data access issues, a position on the transfer of the Joint Polar Satellite System from NOAA to NASA, a position statement on INKSNA, and a strategic plan for STEM Education.

Dr. Holdren, I know you take your role seriously, and as the House Committee responsible for Science, Space, and Technology, we also take our oversight role seriously. Today, we look forward

to receiving your testimony and learning about the current organization and priorities of OSTP and the Administration as part of this Committee's oversight responsibilities.

I thank you, and I yield back my time.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF CHAIRMAN RALPH M. HALL

Dr. Holdren, thank you for joining us today. In your dual role as the President's Science Advisor and as Director of the Office of Science and Technology Policy, you have the President's ear, and as such, you have a real, far-reaching influence on this Administration's direction in science and technology.

We may not always agree with the advice the Director provides to the President, but science and technology have played a vital role in the making of this Nation and will continue to fulfill that role in the future. As such, I doubt you would find anyone here who would challenge the need for science and technology advice in any White House. Throughout U.S. history, that advice has come through both informal and formal methods.

The Office of Science and Technology Policy (OSTP) that we know today is a result of the National Science and Technology Policy, Organization, and Priorities Act of 1976 (P.L. 94–282), which formally created both the Office and established the roles of the Director. The House Committee on Science and Technology was instrumental in the passage of this Act, and it is our responsibility to make sure that the Office continues to function in a way that is beneficial to American citizens. While Directors historically have joined us annually to review the Administration's Budget Request and have appeared before us on specific issues from time to time, this is the first time this Committee has met to focus primarily on oversight of OSTP since it was created in statute.

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Thank you, and I yield back my time.

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

Ms. JOHNSON. Thank you very much, Mr. Chairman, and good morning. We are pleased to have the second hearing with Dr. Holdren at the Committee.

As you know, every year we invite the Director of the Office of Science and Technology Policy to appear before the Committee to help us understand not just that year's R&D budget but others as well.

We live in an increasingly complex world, and the challenges we face will be both impacted by and hopefully alleviated by science and technology. As Americans, we should celebrate the fact that a highly respected scientist such as Dr. Holdren has the ear of the President and is truly part of his inner circle of advisors on matters of science and technology. We in Congress also can benefit from

good advice on matters of science and technology policy, and I am looking forward to your testimony today.

The truth is that OSTP has been asked to do a lot by both Congress and the President. In addition to your more visible initiatives, I know that you have to carry out necessary interagency coordination, a job that probably goes underappreciated and undervalued by all of us. The work of OSTP staff helps to minimize unnecessary duplication in research and development programs across the government and ensure that significant research gaps are addressed.

Dr. Holdren, you have been asked to testify about the structure, function and funding of your office, as well as the two hats you wear as both Science Advisor to the President and Director of the Office of Science and Technology Policy. You face many challenges, some of which you inherited, such as the NOAA satellite program, and others that are more recent, such as the arm-twisting you probably had to do to get agencies to complete their scientific integrity policies. I think we forget sometimes that your actual authority is limited and that much of what you accomplish is through your leadership, persuasion and persistence.

As you know, I care deeply about the need to ensure that we remain competitive in a challenging world economy as well as improve the quality of life for all our citizens. Research and innovation are essential ingredients of any effort to meet those two goals, as is STEM education. You have a number of initiatives underway related to STEM education, and I would like to hear how those are faring and any issues that you are facing.

With respect to research and innovation, I would like to hear about your efforts to promote innovation and to move new technologies towards commercialization. I know that the Administration has a number of initiatives underway in that regard, such as the *Startup America Initiative*, and I would like to get your assessment of how well those initiatives are working and what additional steps may be needed.

And finally, in addition to hearing about your key priorities and goals for your office, I would like to hear what you might need from Congress, whether it is related to a general function of your office or to a specific goal or task. You have an important responsibility, and we want you to succeed.

Dr. Holdren, I look forward to your testimony and I yield back the remainder of my time.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF RANKING MEMBER EDDIE BERNICE JOHNSON

Thank you, Chairman Hall, for holding this hearing and wecome, Dr. Holdren, to the Committee for the second time this year. As you know, every year we invite the OSTP Director to appear before the Committee to help us understand not just that year's R&D budget request but also your office's role in the federal R&D enterprise.

We live in an increasingly complex world, and the challenges we face will be both impacted by and—hopefully—alleviated by science and technology. As Americans, we should celebrate the fact that a highly respected sceintist such as Dr. Holdren has the ear of the President and is truly part of his inner circle of advisors on matters of science and technology. We in Congress also can benefit from good advice on matters of science and technology policy, and so I am looking forward to your testimony today.

The truth is that OSTP has been asked to do a lot by both Congress and the President. In addition to your more visible initiatives, I know that you have to carry out necessary interagency coordination—a job that probably goes underappreciated and undervalued by all of us. The work of OSTP staff helps to minimize unnecessary duplication in R&D programs across the government and ensure that significant research gaps are addressed.

Dr. Holdren, you have been asked to testify about the structure, function, and funding of your office, as well as the two hats you wear as both Science Advisor to the President and Director of OSTP. You face many challenges, some of which you inherited, such as the NOAA satellite program, and others that are more recent, such as the arm-twisting you probably had to do to get agencies to complete their scientific integrity policies. I think we forget sometimes that your actual authority is limited and that much of what you accomplish you do through leadership, persuasion, and persistence.

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Dr. Holdren, I look forward to your testimony and I yield back the remainder of my time.

Chairman HALL. I thank you, Ms. Johnson.

At this time, if there are Members who have opening statements, they will be added to the record.

PREPARED STATEMENT OF SUBCOMMITTEE ON SPACE AND AERONAUTICS CHAIR JERRY F. COSTELLO

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
U.S. Congressman Jerry Costello

The Office of Science and Technology Policy: Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 AM to 12:00 PM
2318 Rayburn House Office Building

- Mr. Chairman, thank you for holding today's hearing on the Office of Science and Technology Policy (OSTP) to examine its role and effectiveness in advancing science policy in the United States.

- OSTP's core mission is to advise the President on science and technology policy and coordinate its implementation throughout the federal government. This task is crucial to maintaining U.S. leadership in science and technological research and development (R&D) and advancing our competitive edge in the global economy.

- Since it was established by Congress in 1976, the OSTP has played an integral role in U.S. scientific achievement and serves an important role in advancing areas, such as advanced manufacturing R&D and boosting

Science, Technology, Engineering, and Mathematics (STEM) education in our classrooms.

- I support many of OSTP's goals and believe it is important Congress continue its oversight responsibilities of executive branch agencies to ensure efficient use of taxpayer dollars. In February, this Committee examined OSTP's budget proposal for Fiscal Year 2013. During that hearing, I raised concerns over the Obama administration's vision for NASA – particularly in light of cuts to the SLS, MPCV and the Mars Exploration program, and the significant request for commercial crew development.

- Those issues were explored in-depth during the Space and Aeronautics Subcommittee hearing on NASA's Fiscal Year 2013 budget. As Ranking Member of that Subcommittee, I remain concerned about the Administration's commitment to developing these programs as defined by the NASA Authorization Act of 2010, while also balancing our efforts to grow commercial providers and research capabilities on the

International Space Station (ISS). I look forward to hearing more from Dr. Holdren on OSTP's role in carrying out these important priorities.

- It is important that the federal government maintain an active role in research and development activities, particularly as we work toward advancements in clean energy technologies such as clean coal and producing higher blends of ethanol. Finally, I want to thank Dr. Holdren for his leadership and work at OSTP and I look forward to his testimony. Thank you again, Mr. Chairman.

And at this time, I would like to introduce our witness. Dr. John Holdren is Assistant to the President for Science and Technology, 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. Chairman, as our witness should know, spoken testimony is limited to five minutes, but you are a very important and valuable witness. We will be a little more lenient with that with you if you need such, and I say that; if I didn't say it, Ms. Johnson would insist on it, so it is easier for me just to take that position, so we are going to be fair with you is what I am trying to tell you. After that, the Members are going to have five minutes each to ask questions and the Chair is able to provide some flexibility, as I said, as you are the only witness today, Doctor. I thank you for your testimony.

Reminding Members of the Committee that rules limit our questioning to five minutes, and I surely will adhere to that.

We recognize you at this time while I look for my testimony.

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

Mr. HOLDREN. Chairman Hall, Ranking Member Johnson, Members of the Committee, I am pleased to be here with you today to discuss the organization that I lead in the Executive Office of the President, namely the Office of Science and Technology Policy.

As you know, science, technology, and innovation have been at the core of the American success story since the days of the Founding Fathers. Advances in agronomy, electrification, mechanized transportation and wireless communication, among others, have each in their time brought waves of economic growth, generated new opportunities industries and jobs while also raising policy challenges. It was in recognition of the importance of these domains and challenges that Congress in 1976 created OSTP to advise the President on the scientific, engineering and technological aspects of the issues before him and to help coordinate, lead and develop budgets for federal R&D programs.

Today, OSTP's work is accomplished by a staff of about 100 people spread across four divisions and the Director's Office. Almost 90 percent of these are science and technology professionals, many of them detailed to us from agencies. This diversity of talent is essential, given the scope of the intellectual terrain that we cover and the wide range of our oversight, coordination and support functions, which include running the National Science and Technology Council and the major interagency initiatives that fall under it, for example, the U.S. Global Change Research Program and the National Nanotechnology Initiative, as well as supporting the President's Council of Advisors on Science and Technology in the development of its reports for the President.

I have submitted for the record a detailed summary of OSTP's activities, and in my brief remarks this morning, I will highlight just a few of these.

First, reflecting the Administration's strong focus on jobs and the economy, OSTP has been active in efforts to leverage science and technology for economic growth. We partnered with the Council of Economic Advisers and the National Economic Council to develop the Administration's Strategy for American Innovation, and we launched such jobs-focused initiatives as Startup America, focused on small businesses and entrepreneurs, the Advanced Manufacturer Partnership, which brings together universities, industry and others to invest in emerging technologies that have the potential to create high-quality domestic manufacturing jobs, and most recently, U.S. Ignite, aimed at accelerating availability to U.S. users of ultrafast Internet and new products and services based on it.

Second, in support of the Administration goal that the United States lead the world in clean energy technology, we have prioritized budgetary support for basic and applied research in this important domain and have pushed the development of advanced materials, in part through the Materials Genome Initiative, which is another public-private partnership combining the comparative advantages of both sectors.

Third, OSTP has very actively supported science, technology, engineering and math education. We worked with the President and the Domestic Policy Council to launch Educate to Innovate, a public-private partnership to improve K–12 STEM education that has attracted more than $700 million in corporate and philanthropic commitments to work in classrooms across the country to improve instruction in science and mathematics and Change the Equation, a nonprofit organization that is mobilizing the business community to improve STEM education across the United States. And we have been aggressively addressing STEM education tasks specified in the America COMPETES Reauthorization Act, including completion of a comprehensive inventory of federal STEM education programs.

Fourth, I want to mention OSTP's leading role with other White House offices in the implementation of the President's Open Government Initiative. Under the leadership of U.S. Chief Technology Officer, Todd Park, we have been opening the workings of government to the American people and focusing heavily on making government data a driver of private-sector innovation and job creation.

In closing, let me simply say that with continuing support from our partners in Congress, OSTP is working every day to ensure that the policies and proposals emanating from the Executive Branch are informed by the most up-to-date and objective insights about the relevant science and technology and to strengthen the U.S. science, technology and innovation enterprise and the benefits to the Nation that flow from it.

I look forward to continuing to work with this Committee to these ends, and I will be pleased to answer any questions that the Members may have. Thank you.

[The prepared statement of Mr. Holdren follows:]

OSTP June 2012 testimony for the House Committee on Science, Space, and Technology

Statement of Dr. John P. Holdren
Director, Office of Science and Technology Policy
Executive Office of the President of the United States
to the
Committee on Science, Space and Technology
United States House of Representatives
on
the Office of Science and Technology Policy
June 20, 2012

Chairman Hall, Ranking Member Johnson, and Members of the Committee, it is my distinct privilege to be here with you today to discuss the organization I lead, the White House Office of Science and Technology Policy.

Science, technology, and innovation have been at the core of the American success story since the days of the Founding Fathers. Advances in agronomy, electrification, mechanized transportation, and wireless communication have each, in their time, brought waves of economic growth, generated new opportunities, industries, and jobs, and—increasingly—posed difficult decisions and policy dilemmas. How to satisfy our Nation's energy needs without compromising its environment? How to ensure that increasingly sophisticated healthcare will remain affordable for those who need it? How to exercise our freedom to chat over the airwaves without losing our identities or privacy in the process?

By the early-to-mid-20th century, the Federal Government was grappling regularly with the dual questions of how best to support scientific and technological development to enable national security, economic growth, and social wellbeing and, at the same time, how to ensure that competent science advice was available to top decision-makers when they needed it. By 1941, the need for a formal mechanism by which the President could get reliable science and technology advice had become clear enough to spur President Franklin D. Roosevelt to establish the Office of Scientific Research and Development. Every President since then has had the benefit of some sort of science and technology office—and a resident science and technology advisor—inside the Executive Office of the President (EOP).

President Nixon dismantled the EOP's Office of Science and Technology at the beginning of 1973, but the function was restored in 1976 by act of Congress—the National Science and Technology Policy, Organization, and Priorities Act of 1976 (Public Law 94-282), which authorized and created within the EOP the Office of Science and Technology Policy (OSTP). P.L. 94-282 charges OSTP with a broad mission of advising the President on the scientific, engineering, and technological aspects of issues that require attention at the highest levels of Government, including, but not limited to, the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources. It also charges OSTP with providing general leadership and coordination of the research and development programs of the Federal government; evaluating the scale, quality, and effectiveness of the Federal effort in science and technology; and providing budgetary advice on these topics. The law specifies further that OSTP shall be led by a presidentially appointed, Senate-confirmed Director, and it authorizes up to four Associate Directors, also appointed by the President and subject to Senate confirmation. For most of the intervening 36 years, the four

authorized Associate Director positions have in fact been filled, with the incumbents overseeing, respectively, a science division, a technology division, an environment division, and a division covering national security and international affairs.

Since the creation of OSTP by Congress in 1976, as well as in the case of the predecessor offices created under presidential authority, the director of the EOP science and technology office has also served as "the President's science advisor", often (as now) with the title Assistant to the President for Science and Technology.

In the remainder of this testimony, I will supply some additional detail about the structure and activities of OSTP in the Obama Administration.

Staffing and Budget

OSTP's work is accomplished with approximately 27 full-time equivalent staff supported by the OSTP appropriation, which includes the OSTP Director, the leaders of the Science, Technology, Environment and Energy, and National Security and International Affairs Divisions, additional technical experts focused on cross-cutting innovation issues, and a small administrative team. In addition, there are 51 scientific and technical experts detailed to OSTP from all across the executive branch, plus 9 experts brought in from outside the Federal government under the Intergovernmental Personnel Act (IPA) and 6 additional staff supported at OSTP through various fellowship arrangements. (Earlier this year, I provided the Committee a detailed list of the home agencies and institutions of our detailees, IPA staff, and fellows.) This mix of personnel allows OSTP to tap a wide range of expertise and leverage a multitude of high-value resources to ensure that the science and technology work of the Federal government is appropriately supported, coordinated, and amplified.

The President's 2013 Budget requests $5.85 million for OSTP operations, above the $4.50 million 2012 enacted funding level but 12.0 percent below the $6.65 million 2011 enacted funding level. The reduced 2012 OSTP funding level required significant reductions in staffing and support. If the 2013 Budget's proposal for OSTP is enacted, this would return OSTP personnel and support funding closer to levels commensurate with the magnitude of our responsibilities, on which I now expand a bit from the brief account above.

OSTP Responsibilities and Activities

As directed by law, OSTP coordinates the development and implementation of U.S. domestic and international science and technology (S&T) policies, programs, and—in collaboration with the Office of Management and Budget (OMB)—provides recommendations to the President on the S&T components of his annual budget proposal to the Congress. (In my appearance before this Committee in February, I testified on the important investments in research, education, and infrastructure called for in the President's 2013 Budget, so I will not focus further here on that aspect of OSTP's work.) OSTP also supports me in my role as Assistant to the President for Science and Technology and the U.S. Chief Technology Officer, who sits in OSTP, in our functions advising the President on S&T dimensions of the policy challenges before the Nation, including strengthening the economy and creating jobs, improving healthcare and education, enhancing the quality of the environment, and advancing national and homeland security.

In addition, OSTP provides liaison to the White House for the major S&T agencies that do not sit in cabinet departments, most notably the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the Smithsonian Institution. And OSTP serves as a "convener," fostering science, technology, and innovation partnerships among Federal, State, and local governments and the scientific communities in industry and academia; managing the interagency National Science and Technology Council (NSTC) and the President's Council of Advisors on Science and Technology (PCAST); co-managing (with the Council on Environmental Quality) the National Ocean Council (NOC); and co-managing (with OMB and the Office of the United States Trade Representative) the Emerging Technologies Interagency Policy Committee (ETIPC). OSTP's statutory responsibilities also include carrying out a range of functions in support of national security and emergency preparedness communications, and coordinating and overseeing U.S. cooperation in science and technology with other nations.

While OSTP has had a long and strong history as the epicenter of White House science and technology policymaking and as a key source of sound advice to the President and other Administration officials on S&T-related issues, its responsibilities have become even more demanding in this Administration because of the magnitude of the economic challenges facing the country and the strong historical and projected role of science, technology, and innovation in economic growth and job creation. At the heart of OSTP's expanded efforts in this domain have been initiatives – many in partnership with other White House offices – to promote advanced manufacturing; create new public-private partnerships in areas such as science, technology, engineering, and mathematics (STEM) education; and improve access to government data and services. OSTP continues to play key roles supporting the Administration's priorities in energy, space, environmental monitoring, STEM education, climate change, scientific integrity, regulatory reform, and cybersecurity, among others. In what follows I elaborate on a number of these OSTP activities.

Advanced Manufacturing, Innovation, Entrepreneurship, and Job Creation

OSTP partnered with the Council of Economic Advisers (CEA) and the National Economic Council (NEC) to develop and release a detailed and historic *Strategy for American Innovation*.[1] This strategy, first announced by the President in September 2009 and updated in February 2011, outlines the Administration's commitment to invest in the building blocks of American innovation, promote competitive markets that spur productive entrepreneurship, and catalyze breakthroughs for national priorities. The Strategy has provided a valuable framework for integrating Administration science, technology, and innovation initiatives relating to STEM education, job creation, advanced manufacturing, and other topics.

At the core of OSTP's activities in advanced manufacturing is the Advanced Manufacturing Partnership (AMP). Launched by the President in June 2011, the AMP is a national effort that brings together industry, universities, and the Federal government to invest in emerging technologies that will create high-quality manufacturing jobs and enhance our global competitiveness. The partnership builds on the *Strategy for American Innovation* and its creation

[1] http://www.whitehouse.gov/innovation/strategy

was called for in *The Report to the President on Ensuring American Leadership in Advanced Manufacturing*, released by PCAST in June 2011.[2]

Reflecting that PCAST report's recommendations and the priorities outlined by the President in his 2012 State of the Union address, the 2013 Budget proposes a total investment of $2.2 billion for Federal advanced-manufacturing R&D at NSF, the National Institute of Standards and Technology (NIST), the Department of Defense (DOD), the Department of Energy (DOE), and other agencies. OSTP has worked closely with NEC and with the agencies above to develop and implement specific advanced-manufacturing proposals. The 2013 Budget also reflects recommendations in *A National Strategic Plan for Advanced Manufacturing*, a comprehensive strategic plan released in February 2012 to guide Federal advanced manufacturing R&D investments; the plan was crafted in response to Section 102 of the America COMPETES Reauthorization Act of 2010 (Public Law 111-358).[3]

More recently in April 2012, OSTP launched Manufacturing.data.gov. This new community on Data.gov is a one-stop Web portal for anyone interested in sharing ideas and transforming emerging technologies into commercial success stories. It serves as a public resource of high-value datasets, tools, and applications that can help entrepreneurs with the entire product development chain for a project, from invention, engineering design and prototyping, to validation and testing, manufacturing, and sales. The manufacturing datasets include ready-to-license intellectual property from Federal agencies, Federal funding opportunities, Federal programs in advanced manufacturing, shared facilities, software tools, and apps.

As part of this broader manufacturing effort, OSTP also helped launch the National Robotics Initiative (NRI) last summer to support the development of robots that work with or beside people to extend or augment human capabilities. OSTP has convened Federal agencies to coordinate their investments in robotics R&D as part of the NRI. The initiative launched with tens of millions of dollars in combined commitments from NSF, the National Institutes of Health (NIH), the U.S. Department of Agriculture (USDA), and NASA, and has already resulted in a number of projects moving forward. The 2013 Budget would continue the NRI with additional investments in robotics R&D.

Another important component of the broader Federal R&D agenda that contributes to advanced manufacturing is the Materials Genome Initiative. In the same way that the Human Genome Project accelerated a range of biological sciences by identifying and deciphering the human genetic code, this initiative will speed our understanding of the fundamentals of materials science, providing a wealth of practical information that American entrepreneurs and innovators will be able to use to develop new products and processes. In May, OSTP convened a White House event bringing together leaders from industry, academia, national labs, and government to announce more than a dozen new commitments to advance the Materials Genome Initiative. These new commitments added to previously announced Administration investments spanning nine Federal programs, and keep us on track to achieve the President's vision for advanced materials.

[2] http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-advanced-manufacturing-june2011.pdf
[3] http://www.whitehouse.gov/sites/default/files/microsites/ostp/iam_advancedmanufacturing_strategicplan_2012.pdf

In addition to the manufacturing-related efforts I have described, OSTP is taking other steps in the public and private sectors to maximize the impact of the Federal R&D investment for innovation, with the goal of transforming the Nation's economy and improving the lives of all Americans.

One way to spur innovation in the public and private sectors and to maximize the impact of the Federal R&D investment for innovation is to use prizes or challenges. Over the past three years, OSTP has been leading the Administration's efforts to make incentive prizes a standard tool in every agency's innovation toolbox. Section 105 of the America COMPETES Reauthorization Act of 2010 granted all Federal agencies broad authority to conduct prize competitions to spur innovation, solve tough problems, and advance their core missions. By significantly expanding the authority of all Federal agencies to conduct prize competitions, the legislation is an important step forward that enables agencies to pursue more ambitious prizes with robust incentives.

Over the past year-and-a-half, the Administration has laid the policy and legal groundwork to take maximum advantage of the new prize authority in the years to come. Policy and legal staff in OSTP and OMB jointly developed a Fact Sheet and Frequently Asked Questions memorandum issued in August 2011 to streamline implementation of the new, government-wide authority. In collaboration with the General Services Administration (GSA), we also launched Challenge.gov, a public-facing platform that Federal agencies can use to run a challenge competition. In addition to having a central platform that saves taxpayer dollars, Challenge.gov brings together information on Federal prize competitions and challenges in one place, making it easier for citizen solvers from across the country to participate. And this spring, OSTP submitted to Congress a full progress report on how the America COMPETES Reauthorization Act's prize authority is being implemented throughout the Federal government and how this authority is boosting innovation.

In addition to Federal investments, we are also working to build public-private partnerships to boost innovation and entrepreneurship. In January, for example, the Administration celebrated the one-year anniversary of Startup America (SUA), a campaign to inspire and accelerate high-growth entrepreneurship that OSTP helped to convene and continues to advise. This spring, SUA unveiled a number of Administration and private-sector actions geared toward expanding access to capital, cutting red tape, and accelerating innovation for small businesses and entrepreneurs. The private sector answered the President's call to action last year by forming the Startup America Partnership, a nonprofit alliance of successful business owners, major corporations, and service providers dedicated to making entrepreneurship more successful.

Clean Energy

It is a high-level Administration goal that the United States lead the world in research and development of clean-energy technology to reduce dependence on oil and other energy imports and mitigate the impact of climate change while creating high-paying, high-skilled clean-energy jobs and new businesses. The Administration's budgets have reflected a comprehensive strategy for supporting clean energy, which starts with basic and applied research to address some of the fundamental unknowns to advancing clean-energy technologies; continues with the development of advanced light-weight, ultra-strong materials; is followed by research and development to create clean-energy products, like solar panels, batteries and electric vehicles, wind turbines, and

modular nuclear reactors; and includes the provision of appropriate assistance to American entrepreneurs to commercialize these products.

OSTP has been helping to advance a national energy strategy by bringing to bear science and technology to solve some of the most difficult energy policy challenges the United States faces. For example, OSTP developed, in collaboration with NEC and the Council on Environmental Quality (CEQ), the *Policy Framework for a 21st Century Grid*,[4] a plan for empowering consumers with tools to better manage their electricity and cut costs; improving the reliability of the electric grid; and helping utilities recover more quickly from natural disasters. In addition, following up on a PCAST recommendation, OSTP in partnership with DOE helped launch DOE's Quadrennial Technology Review process, aimed at a more coordinated and comprehensive strategy for achieving clean-energy goals.

Space

OSTP has long had a role in preserving and advancing U.S. capabilities in space, which are essential for communications, geopositioning, intelligence-gathering, Earth observation, and national defense, as well as for increasing our understanding of the universe and our place in it. The President's decision in early 2010 to repair an unaffordable and unexecutable human-spaceflight program and to restore advanced technology capabilities, and subsequent negotiations with Congress, resulted in the NASA Authorization Act of 2010, which calls for an ambitious and exciting human-spaceflight program and revitalized science and advanced-technology programs at NASA within an affordable budget. OSTP continues to work with OMB and NASA to implement the NASA Authorization Act and to protect the International Space Station's role as a National Laboratory; to support commercial-crew efforts to get U.S. astronauts into Earth orbit; to reconcile completion of the James Webb Space Telescope and other important science missions with other essential NASA missions; and to continue investing in advanced technologies for space exploration.

OSTP also oversees and has reinvigorated interagency collaborations on space-based Earth observations. In the first year of the Administration, the President charged OSTP to work with OMB, the National Oceanic and Atmospheric Administration (NOAA), NASA, and DOD to restructure a troubled polar-orbiting satellites program. Since the announcement of the restructured program in early 2010, OSTP has been overseeing it and working with the above agencies and the U.S. Geological Survey (USGS) to ensure continuity in weather, climate, and other environmental data from Earth-observation satellites. OSTP also leads the Group on Earth Observations (GEO) effort that coordinates the international community's effort in this domain.

Scientific Integrity

One of my overarching tasks as the Director of OSTP is to ensure the integrity of scientific and technical work across the executive branch. It is a broad responsibility, made explicit by President Obama in his March 9, 2009, Presidential Memorandum for the Heads of Executive Departments and Agencies. In it he highlighted six principles of scientific integrity that would be at the core of this Administration's approach to policy making. And he asked me,

[4] http://www.whitehouse.gov/sites/default/.../nstc-smart-grid-june2011.pdf

in collaboration with other Federal officials, to craft recommendations for ensuring scientific integrity throughout the executive branch.

Responding to that initial call by the President—amplified in a December 2010 memorandum developed by OSTP with significant input from science stakeholders and the public—departments and agencies across the Federal government crafted scientific-integrity policies to guide them as they pursue their diverse missions. OSTP worked with departments and agencies to help them develop individual scientific-integrity policies tailored to each entity's mission, responsibilities, and needs. By codifying, for the first time, explicit practices to protect scientific integrity in each department and agency, we helped to ensure that the important goals of technical rigor, transparency, and protecting science from political interference are achieved not only in this Administration but in future Administrations as well. Every covered department and agency has publicly released its scientific-integrity policy.

While many of these final policies are new, it is important to keep in mind that ground rules for scientific integrity have been in place since the earliest days of this Administration, fulfilling a promise President Obama made on Inauguration Day to "restore science to its rightful place." The March 2009 Memorandum's guiding principles of scientific integrity have been in effect since the beginning of the Administration across the executive branch; the individual policies tailor the guiding principles to each entity's mission, responsibilities, and needs.

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

In his remarks at the second White House Science Fair in early February 2012 (an event hosted by OSTP, as was the first science fair in the fall of 2010), the President called for an "all-hands-on-deck" approach to STEM education. "Let's train more teachers. Let's get more kids studying these subjects. Let's make sure these fields get the respect and attention that they deserve," he said. Since the start of the Administration, OSTP has been active with NSF, the Department of Education (ED), and the Domestic Policy Council in formulating and implementing new strategies to achieve the President's vision of improving STEM education for students at all levels. Early in the Administration, OSTP launched Educate to Innovate, a public-private partnership to improve K-12 STEM education that has attracted more than $700 million to date in private-sector commitments to work with young people across America to excel in science and mathematics. One of the efforts resulting from this partnership is Change the Equation, a non-profit organization dedicated to mobilizing the business community to improve the quality of STEM education in the United States.

This year, to support the Administration's ongoing focus on STEM education, OSTP has helped assemble a 2013 Budget that proposes $3.0 billion in programs across the Federal government on STEM education, a 2.6 percent increase over the 2012 enacted funding level. The 2013 Budget makes disciplined choices guided by drafts of the Federal STEM-education strategic plan, cutting back on lower-priority programs to make room for targeted increases and reducing duplication and overlap. The Budget proposes elimination or consolidation of programs that would reduce the total number of Federal STEM-education programs to 209 from 235 in FY 2012.

These efforts in the 2013 Budget are part of a broader OSTP and Administration-wide commitment to look carefully at the effectiveness of all STEM programs and find ways to

improve them. To further this goal, last year I established a Committee on STEM Education under the NSTC as called for in Section 101 of the America COMPETES Reauthorization Act of 2010. In December 2011, the Committee released the most comprehensive inventory of Federal STEM efforts ever compiled.[5] The Administration also released a description of a 5-year Federal STEM-education strategic plan and an update to the Federal STEM inventory along with the 2013 Budget, as called for in the COMPETES reauthorization. In April, OSTP published detailed data on federal STEM-education activities, the *2010 Federal STEM Education Inventory Data Set*. The data set is accessible on the OSTP site and also at data.gov, and it includes information on STEM-education programs the Federal Government funded in 2010, what audiences were targeted, what outcomes were monitored, and much more. The final STEM-education strategic plan, to be released later this year, will outline a path to increase coordination and collaboration among the 13 agencies that support STEM education and increase the efficiency and impact of the Federal portfolio of STEM-education programs.

Open Government and Open Data

On his first day in Office, President Obama signed a Memorandum on Transparency and Open Government, ushering in a new era of open and accountable government meant to bridge the gap between the American people and their government. In December 2009, the White House issued an Open Government Directive requiring Federal agencies to take immediate, specific steps to achieve key milestones in transparency, participation, and collaboration. OSTP is a key partner in Open Government Initiative activities, with a focus on improving access to government data and services through the use of technology and supportive S&T policies.

OSTP has worked with OMB, GSA, and other Federal partners to open up Federal government data to the public through innovative technology. Data.gov, the U.S. government's open data site, has grown from 47 datasets at its founding three years ago to nearly 450,000 datasets today, Data.gov reaches across the Federal government to bring data to innovators, developers, analysts, and citizens across the Nation. The data show up in smart phone apps, websites, and other platforms, and help people buy smarter, use energy more efficiently, and find better health-care solutions each day, among countless other applications. Over the past year, Data.gov has become a gathering spot for those with shared interests through its topic-based communities. OSTP has been active in launching the Manufacturing, Ocean, and Energy communities on Data.gov, with more to come. The Federal government also has a growing collection of performance and accountability websites, including the Open Government Dashboard, Recovery.gov, Usaspending.gov, the IT Dashboard, the R&D Dashboard, and Performance.gov, that provide unprecedented detail on Federal spending and performance.

OSTP continues to partner with Federal departments and agencies and other White House offices to expand the capabilities of these Open Government projects. The Administration is building out Open Government through initiatives such as the Open Data Initiatives and the Digital Government Strategy, announced last month, to make government and private-sector data widely available to the public in machine-readable formats that are ready for use by private-sector innovators to develop useful apps on mobile platforms.

[5] This report and other STEM-education reports and data sets are available at http://www.whitehouse.gov/administration/eop/ostp/nstc/committees/costem#STEMEducation

These open data initiatives are having positive impacts in several domains. For example, in August 2010, President Obama announced the creation of an online "Blue Button"—a web-based feature through which patients may easily download their health information and share it with health care providers, caregivers, and others they trust. Since then, the Department of Veterans Affairs (VA) and the Centers for Medicare and Medicaid Services (CMS) in HHS have launched Blue Button systems with great success, and private-sector vendors are creating applications that provide secure, reliable, and portable personal health records while supporting the Administration's goal of encouraging greater use of health IT, including electronic health records. OSTP, through the office of the Chief Technology Officer, has helped implement these efforts, and millions of Americans are already taking advantage of this technology.

Building on the success of the Blue Button initiative, the Administration in early 2012 launched the "Green Button" initiative, an effort led by OSTP (in coordination with CEQ and DOE) based on a simple, common-sense goal: provide electricity customers with easy and secure access to their energy usage data in a consumer-friendly format via a "Green Button" on utilities' websites. Millions of Americans already have access to this data thanks to the Green Button initiative. With this information in hand, customers can take advantage of innovative energy apps to help them understand their energy usage and find ways to reduce electricity consumption and shrink bills. This is another way that OSTP is leveraging technology and data to make progress toward policy goals.

Big Data

In late March, the Administration announced the "Big Data Research and Development Initiative." By improving our ability to extract knowledge and insights from large and complex collections of digital data, the initiative promises to help accelerate the pace of discovery in science and engineering, strengthen our national security, and transform teaching and learning.

To launch this interagency Federal research initiative, six Federal departments and agencies announced more than $200 million in new commitments that, together, promise to greatly improve the tools and techniques needed to access and organize information and glean discoveries from huge volumes of digital data. OSTP convened the interagency discussions leading to the announcement, and will continue to be engaged with the agencies in implementing their Big Data R&D programs.

Public Access to the Results of Federally Funded Research

The Administration recognizes that improving access to the results of federally-funded research will increase the impact and accountability of the Federal research enterprise by helping scientists and the private sector apply research results to their practice more effectively. OSTP has been active for some time on this issue. Most recently, in response to Section 103 of the America COMPETES Reauthorization Act of 2010, OSTP established NSTC interagency working groups on public access to publications and to digital data, to identify the specific objectives and public interests that need to be addressed by any policies in these two areas.

OSTP has conducted two public solicitations for comments on these topics, inputs from which are posted on our website.[6] The working groups have analyzed these comments, and in the spring OSTP delivered a report updating Congress on the status of these efforts and comments. OSTP is now working with Federal agencies to develop policy options in these two areas.

Cybersecurity and National-Security Communications

OSTP is an active participant in the Federal government's efforts to keep cyberspace secure. Early in the Administration, the President ordered a top-to-bottom review of the Government's cyberspace policy. The resulting *Cyberspace Policy Review*[7] challenged Federal agencies to develop a targeted set of cybersecurity research priorities to "change the game" so that cyberspace can become safer and more trustworthy—key to facilitating continued growth of the Nation's digital infrastructure.

In 2011, OSTP released *Trustworthy Cyberspace: Strategic Plan for the Federal Cybersecurity Research and Development Program*—a road map to ensuring long-term reliability and trustworthiness of the digital communications network that is increasingly at the heart of American economic growth and global competitiveness.[8] The cybersecurity R&D strategic plan seeks to enhance and focus our cybersecurity research and development efforts by setting forth coordinated Federal strategic priorities and research objectives. The plan articulates and defines the Federal government's unique position to leverage its fundamental research resources to address the underlying causes of cybersecurity problems. Using this strategic plan as a road map, OSTP has been working with Federal agencies to implement sustained efforts in these areas toward a more secure and trustworthy cyberspace, working together with researchers and innovators in industry and academia. Together, we can maximize the benefits of research and accelerate their transition into the marketplace.

OSTP also performs certain roles regarding National Security Emergency Preparedness communications under Executive Order and statute. As OSTP Director, I am designated to exercise many of the President's wartime telecommunications authorities in times of emergency. I also exercise several non-wartime emergency telecommunications functions, and OSTP provides support for and continuity in emergency telecommunications.

National Science and Technology Council (NSTC)

OSTP manages and supports the NSTC—a Cabinet-level body that coordinates science and technology policy across the Executive Branch. Established by Executive Order in the Clinton Administration, it succeeds similar efforts in earlier Administrations. The NSTC is chaired by the President, usually represented in this role by the OSTP Director, and brings together S&T agencies throughout the executive branch to coordinate policymaking, ensure that S&T policy decisions and programs are consistent with Administration goals, and ensure that science and technology are appropriately considered in the development and implementation of Federal policies and programs. Most of NSTC's work is carried out through its many

[6] http://www.whitehouse.gov/administration/eop/ostp/library/publicaccess and http://www.whitehouse.gov/administration/eop/ostp/library/digitaldata

[7] http://www.whitehouse.gov/assets/documents/Cyberspace_Policy_Review_final.pdf

[8] http://www.whitehouse.gov/sites/default/files/microsites/ostp/fed_cybersecurity_rd_strategic_plan_2011.pdf

committees, subcommittees, working groups, and task forces focused on specialized topics. Among the many activities operating under the NSTC:

Neuroscience Initiative

OSTP shares with Congress the belief that there is a potential in the near future for significant, transformative advances in our fundamental understanding of learning, brain development, and brain health and recovery. Such advances will require improved neuroscientific tools, enhanced data and data infrastructure, and expanded interdisciplinary research efforts. OSTP has established an NSTC interagency working group to coordinate Federal investments in neuroscience research at NIH, NSF, VA, DOD, and other Federal agencies. The group will help focus and enhance Federal efforts toward a number of promising scientific opportunities, including: developing clinical treatments for traumatic and acquired brain injuries; better understanding of cognition and learning, and applying that understanding to improving education and teaching; and improving our understanding of and therapies for Alzheimer's disease, mental illness, childhood developmental disorders, and other neurological conditions.

National Coordination Offices

Also through NSTC, OSTP manages the National Coordination Offices (NCO) of three longstanding NSTC initiatives: Networking and Information Technology Research and Development (NITRD), the National Nanotechnology Initiative (NNI), and the U.S. Global Change Research Program (USGCRP).

The multi-agency Networking and Information Technology Research and Development (NITRD) initiative provides strategic planning for and coordination of agency research efforts in cyber security, high-end computing systems, advanced networking, software development, high-confidence systems, information management, and other information technologies. The NITRD Program, chartered by Federal law, is the primary mechanism by which the Government coordinates its unclassified networking and information technology (IT) research and development (R&D) investments. Eighteen Federal agencies are formal members of NITRD; many other Federal organizations also participate in NITRD activities. These agencies work together to develop a broad spectrum of advanced networking and IT capabilities to power Federal missions; ensure U.S. science, engineering, and technology leadership; and promote U.S. economic competitiveness. Their efforts increase the overall effectiveness and productivity of Federal networking and IT R&D investments, leveraging strengths, avoiding duplication, and increasing interoperability of networking and IT R&D products. OSTP appoints the NITRD NCO Director and helps lead NITRD via the NSTC's NITRD Subcommittee, which reports to the NSTC Committee on Technology.

The multi-agency National Nanotechnology Initiative (NNI) provides planning for and coordination of agency R&D efforts on the development of materials, devices, and systems that exploit the fundamentally distinct properties of matter at the nanoscale—on the order of a billionth of a meter—and on environmental and health studies relating to nanomaterials. NNI-supported R&D is enabling breakthroughs in disease detection and treatment, manufacturing at or near the nanoscale, environmental monitoring and protection, energy conversion and storage, and the design of novel electronic devices. Furthermore, agencies have identified and are

pursuing Nanotechnology Signature Initiatives in the national priority areas of nanomanufacturing, solar energy, nanoelectronics, and nanotechnology knowledge infrastructure through close alignment of existing and planned research programs, public-private partnerships, and research roadmaps.

The NNI agencies are guided by two strategic documents developed by the Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the NSTC: the 2011 NNI Strategic Plan[9], which aligns nanoscale science and technology research with the NNI's four goals and includes specific, measurable objectives for each goal, and the 2011 NNI Environmental, Health, and Safety Research Strategy[10], which delineates a research and implementation framework that will produce the information necessary to protect public health and the environment, foster product development and commercialization, and consider the ethical, legal, and societal issues associated with nanotechnology development.

OSTP manages the National Nanotechnology Coordination Office (NNCO), which provides technical and administrative support to the NSET Subcommittee, serves as a central point of contact for Federal nanotechnology R&D activities, and provides public outreach on behalf of the NNI. OSTP appoints the Director and the Deputy Director of the NNCO and helps lead the NNI via the NSET Subcommittee of the NSTC.

The U.S. Global Change Research Program (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 OMB work closely with the USGCRP to establish research priorities and plans to maximize research-dollar efficiencies.

USGCRP participating agencies are cooperating to implement the four objectives set forth in USGCRP's new decadal strategic plan,[11] released in April 2012, which are to advance science; inform decisions; conduct sustained assessments; and communicate and educate. A key priority for USGCRP over the coming year will be to conduct an integrated and continuing National Climate Assessment of climate-change science, impacts, vulnerabilities, and response strategies. The OSTP-administered, Congressionally-mandated National Climate Assessment is scheduled to release its next assessment in 2013, following release of a draft for public comment later this year. It will have a strong emphasis on what state and local officials, businesses, and individuals can do to adapt to climate change in their regions that mitigation measures can no longer avoid.

OSTP appoints the Director of the USGCRP NCO—a team of dedicated professionals—and helps lead the NCO and the program via the Subcommittee on Global Change Research under the Committee on Environment, Natural Resources, and Sustainability of the NSTC.

[9] http://www.nano.gov/node/581
[10] http://www.nano.gov/node/681
[11] http://globalchange.gov/what-we-do/strategic-planning

President's Council of Advisors on Science and Technology (PCAST)

PCAST is a Federal Advisory Committee that advises the President, both directly and through OSTP, on science, technology, and innovation policy. Like OSTP itself, similar bodies under variations of the name have existed under Presidents back to Franklin D. Roosevelt. The terms of reference of the current PCAST, specified in Executive Order 13539, call for 21 members, 20 of whom are Special Government Employees (SGE) appointed by the President. They keep their "day jobs" as S&T leaders in the private, academic, and NGO sectors, while serving the President part time and without compensation other than reimbursement for travel and accommodations. The 21st member, who serves as one of the co-chairs, is the Assistant to the President for Science and Technology. The other co-chair is one of the 20 SGE members and is named to this post by the President; the current incumbent is Dr. Eric Lander, a mathematician/genomicist who is Director of the MIT-Harvard Broad Institute of Genomics.

The Obama PCAST has been extraordinarily active and influential. It meets as a committee of the whole for two days every other month and in a ninety-minute conference call in the months in between, and its panels and working groups—addressing tasks agreed with the President—meet in person and by phone more frequently. In the course of this Administration to date, PCAST has completed studies on: the science and technology of 2009-H1N1 influenza; reengineering the influenza-vaccine production enterprise; a congressionally-mandated assessment of the National Nanotechnology Initiative; K-12 STEM education; accelerating the pace of change in energy technologies; realizing the full potential of Health IT to improve healthcare; the Networking and Information Technology R&D initiative; ensuring American leadership in advanced manufacturing; investing in environmental capital and the services that flow from it; and strengthening STEM teaching in the first two years of college.[12] The President has enthusiastically embraced many of PCAST's recommendations on these topics. To give just a few examples of PCAST's impact, its reports have been the foundation for: DOE's Quadrennial Technology Review process, a range of health information-technology initiatives, the Advanced Manufacturing Partnership and other advanced manufacturing policy initiatives discussed earlier in my testimony, and a number of the President's STEM-education initiatives and goals, also discussed earlier.

In December 2011 the President signed an Executive Order[13] transferring PCAST funding and administrative and technical support to the Department of Energy (DOE), but OSTP continues to support PCAST's engagement with the President and the EOP through my role as PCAST co-chair and through PCAST's staff, who continue to be physically located at OSTP.

Joint Commissions on S&T Cooperation

Consistent with statutes, Executive Orders, and international agreements, OSTP serves as the executive agent for the six of this country's bilateral S&T cooperation agreements that are implemented at the "ministerial" level. (These are the agreements with Brazil, China, India, Japan, Russia, and South Korea.) In this connection, I co-chair, with the respective science and technology ministers, the six corresponding Joint Commissions on S&T Cooperation, each of which meets every other year, alternating between the United States and the partner country.

[12] Recent PCAST reports are available at http://www.whitehouse.gov/administration/eop/ostp/pcast/docsreports
[13] Executive Order 13596, December 19, 2011

Other members of the U.S. delegations for these meetings include the heads or deputy heads of the Federal government's major S&T agencies and offices. The counterpart delegations are similarly constituted.

Most of the cooperative projects that take place under the general oversight of the Joint Commissions are developed and implemented through Memoranda of Understanding between individual U.S. departments, agencies, and offices and their foreign counterparts. The principal focuses of these projects in this Administration, as in previous ones, include basic science, public health, energy, Earth observations, climate change, and sustainable agriculture.

I also serve as the U.S. co-chair of the S&T Working Group of the U.S.-Russia Bilateral Presidential Commission, the agreed focuses of which are nanotechnology, IT for government efficiency and openness, and climate science. And I am the U.S. co-chair for the U.S.-China Innovation Dialogue, which has succeeded in getting China to roll back some of the most discriminatory elements of that nation's "indigenous innovation" policies. OSTP also works with the U.S. Department of State and other Federal agencies to improve international S&T cooperation in other bilateral and multilateral relationships.

Emerging Technologies Interagency Policy Coordinating Committee (ETIPC)

In 2010, the Administration formed the Emerging Technologies Interagency Policy Coordination Committee (ETIPC). The ETIPC is part of an effort to ensure that policies affecting emerging technologies of great economic promise—such as nanotechnology and synthetic biology—strike a proper balance between encouraging economically beneficial innovation and commercialization, on the one hand, and protection of safety, health, and environment, on the other. Created jointly by OSTP, the Office of Management and Budget's Office of Information and Regulatory Affairs (OIRA), and the Office of the United States Trade Representative (USTR), the ETIPC consists of representatives from about 20 Federal agencies. As Director of OSTP, I am one of the three co-chairs of the ETIPC.

Innovation with respect to emerging technologies—such as nanotechnology, synthetic biology, and genetic engineering—requires not only coordinated research and development but also appropriate and balanced oversight. To help ensure such balance, in March 2011 EITPC released a memorandum to the heads of executive departments and agencies outlining broad principles to guide the development and implementation of policies for oversight of emerging technologies at the agency level. The principles reflect the Committee's goal of striking a balance in which novel technologies are subject to oversight that is adequate to protect public health and the environment but not so daunting as to unduly slow innovation or the development of those new technologies. Since then, the EITPC has been working to further develop Federal policies for emerging technologies. For example, recognizing that the realization of nanotechnology's full potential will require continued research and flexible, science-based approaches to regulation that protect public health and the environment while promoting economic growth, innovation, competitiveness, exports, and job creation, the ETIPC in June 2011 developed a set of principles specific to nanotech regulation and oversight.

National Ocean Council

President Obama's Executive Order 13547 of July 2010 established a National Ocean Policy and a Cabinet-level National Ocean Council (NOC) to coordinate ocean, coastal, and Great Lakes issues across the Federal Government and to implement other aspects of the Policy. In my capacity as OSTP Director I co-chair the NOC with Nancy Sutley, the Chair of the White House Council on Environmental Quality.

The Policy responds to more than a decade of bipartisan discussions and was formed to resolve a long-standing, well-recognized, and significant problem: the oceans, coasts, and Great Lakes are crucial resources for America, but poor policy coordination within the Federal government and among Federal, State, local, and tribal bodies has resulted in conflicts and delays that hinder economic growth, environmental health, and national security. It is based on the recommendations of the Federal Interagency Ocean Policy Task Force established by President Obama in June 2009, in response to a 2004 report from the U.S. Commission on Ocean Policy, which was appointed by President George W. Bush in 2000.

Since its formation, in multiple meetings of its principals and deputies—and in regional workshops and symposia across the country engaging stakeholders from the private sector, governmental bodies at all levels, and Indian tribes—the NOC has been bringing to bear the expertise of the departments and agencies and the wider community of experts in marine and coastal science, natural resource management, economic development, infrastructure planning, national and homeland security, public health, and social services, along with the perspectives of the diverse stakeholders, to address the most pressing challenges facing the ocean, our coasts, and the Great Lakes. Among the short-term accomplishments of the NOC has been the creation of Ocean.data.gov, a new community on Data.gov that provides one-stop shopping for a wide range of ocean-related data from agencies and making the science that is created by and available to the Federal government accessible to all ocean users.

Conclusion

We live in an increasingly competitive world—a world in which science, technology, and innovation, and the educational and economic policies that nurture capabilities in those domains, can make all the difference between success and failure as a Nation. Guided by Congress's decision in 1976 to establish within the EOP a stable core of scientific and technological expertise and advice, I and my colleagues at OSTP work every day to achieve our mission of supporting and coordinating the U.S. science, technology, and innovation enterprise and deriving for the Nation the steady stream of benefits that issue from this unrivaled American asset. We do this with the help of numerous partners in both the public and private sectors, including other White House offices, Federal departments and agencies, OSTP-managed entities, and the broader science, technology, and innovation community. And we are able to do this because of continued support from our partners in Congress, including this Committee. We hope expect to continue this fruitful partnership, across the entire portfolio in which OSTP operates, in support of most effectively harnessing science, technology, and innovation to address the many challenges we face as a Nation. I look forward to continuing to work with this Committee to this end, and I will be pleased to answer any questions the Members may have.

Chairman HALL. I thank you, sir, and I will start out with some questions for you.

OSTP released a fact sheet highlighting some of the President's energy priorities, and the opening sentence of that fact sheet states that "We now face a make-or-break moment for the middle class and those trying to reach it." However, it is unclear whether the President's energy agenda is actually good for the middle class. The Administration is working to advance these policies, policies to restrict oil and gas exploration and production, and rejected the Keystone pipeline, which would enhance domestic energy security; an avalanche of EPA regulations on coal plants, on refineries, on automobiles and numerous other industries that ultimately will raise energy prices for all Americans; and a "Clean Energy Standard" that would mandate Americans buy electricity from more expensive and less reliable sources such as wind and solar power, which are both good but not as reliable.

How does the "regulate at any cost" approach to energy policy benefit the middle class and the overall American community, not just the middle class but all of us? Explain that to us, if you would, sir.

Dr. HOLDREN. Well, first of all, Mr. Chairman, the President and the Administration have what the President has described as an all-of-the-above energy strategy in which development of our domestic resources of oil and gas and coal plays an important part, nuclear energy plays an important part, renewable energy, which you have mentioned, plays an important part, and increasing energy efficiency plays an important part. We recognize that we need all of these energy options to secure our energy future, and we are working to enable all of them and lift all of them to their highest potential. We do not have a policy of regulation no matter what the cost. In fact, regulations are reviewed very carefully in light of the science evidence that is available before they are put forward, and I think we have been doing a good job in this Administration of only putting forward regulations that are strongly based in solid science. It is certainly our intention to provide an energy future in which the United States imports less energy, therefore pays less to other countries for its imported energy, and relies on a wide diversity of domestic energy sources to provide the affordable and reliable energy supply that our economy needs, that our consumers need, including, of course, the middle class.

Chairman HALL. Well, I don't totally agree with you there, and I think some of his indications, evidence of disdain for energy, he certainly declared war on agriculture early and got around to energy. We have enough energy and enough energy access to be selling energy rather than buying it. I think it is kind of a sad situation when we are in the situation we are in here.

In July or August—I accept what statements you made. I just don't agree with it. In July and August, NASA's Commercial Crew Program is going to select the next round of companies for the third phase of domestic development known as the Commercial Crew Integrated Capability Program. NASA plans to give $300 million to $500 million each to two and possibly three companies using Space Act Agreements instead of more typical government contracts, and according to NASA's Office of General Council, Space

Act Agreements don't permit NASA to impose design or safety requirements on the contracts.

With regard to NASA's use of Space Act Agreements on the Commercial Crew Program, how can we be assured that NASA is developing safe systems if it is prohibited from levying any design requirements, prohibited from demanding performance tests from the companies?

Dr. HOLDREN. Before I turn to that NASA question, let me just mention, Mr. Chairman, that our energy imports have been sharply declining under this Administration. We are moving in exactly the direction that you also endorse, which is moving toward importing less, and I think that is very beneficial.

On the NASA question, it is my understanding that NASA has in fact been able to apply its International Space Station visiting vehicle requirements to the cargo transportation development efforts that have been taking place. The contracts that will be awarded in the next phase of commercial cargo and commercial crew will also very clearly allow NASA to specify safety requirements and to oversee them. So I am certainly confident, the President is confident that we will continue to maintain NASA oversight of safety in these operations.

Chairman HALL. I surely hope so, but my time is expired.

I now recognize Ms. Johnson for five minutes.

Ms. WOOLSEY. You forgot to look to see who is over here—Ms. Woolsey.

Chairman HALL. I am going to make about a five-minute speech about Ms. Woolsey. We are going to lose her, and I am going to miss her. I recognize you, and if Ms. Johnson is here, I would recognize her.

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

Chairman HALL. I have to be more careful.

Ms. WOOLSEY. Yes, you do, more discerning about your women.

So Dr. Holdren, thank you for all you do. We put a lot of importance on your office and we expect a lot, and we get a lot.

How is the United States stacking up as compared to the rest of the world in our support for science and technology and the policies that we put in place? And feel free to tell us where we could do better.

Dr. HOLDREN. Well, first of all, I would say that the United States continues to lead the world in science, engineering and innovation across a very wide array of crucial fields of fundamental research and applied research. The United States leads the world. We remain by far the largest funder of research and development in the world. The sum of our expenditures on R&D in the public and private sector together is over $400 billion a year. That is in the vicinity of 30 percent of all of the world's expenditures on R&D. We continue as well to lead the world in space, although sometimes the contrary is asserted. Our planetary exploration programs have absolutely no peer. We have missions on the way to or at seven out of the eight officially designated planets and more. The Voyager is now reaching the edge of the solar system; we have missions to asteroids. No one is even close.

When you look at the firsts in space, some people say gee, China is overtaking us. Well, China just put its first woman in space a

few days ago. We put our first woman in space, Sally Ride, in 1983. One can go on through the list. China is talking about maybe being able to land someone on the moon after 2020. We did it in 1969.

The one area where I think we need to work much harder is one I have already mentioned, the area of STEM education, where the United States that used to lead the world in most indices of performance in STEM education has now fallen to the middle of the pack. That is a bad trend and one we are working very hard across a wide variety of fronts to help remedy.

At the same time, I would argue that across the board, we cannot afford to be complacent. One of the areas that is clearly crucial in linking science and technology and innovation to the economy is the translation of discovery from laboratories in research universities and our great national laboratories, accelerating the translation of those discoveries into commercial products and services and new processes, and there the American Manufacturing Partnership, the Materials Genome Initiative, the Startup America Initiative are all aimed at accelerating and making more efficient the processes by which we turn scientific and engineering advance into economic advantage.

Ms. WOOLSEY. So because we are increasingly on the cutting edge of science and there is intersections of multiple disciplines, what are the challenges that you face involving different federal agencies, academia and industry in the efforts of our country to go forward with science and technology?

Dr. HOLDREN. Well, thank you for that question. Let me answer it in two parts. First is the question of interagency engagement and coordination, and there, as mentioned at some length in my testimony, OSTP has the responsibility and I have the responsibility as its Director to oversee and lead efforts to coordinate science, technology and innovation initiatives that cross agency boundaries, and for that purpose, we have the National Science and Technology Council, which is nominally chaired by the President but in practice usually I chair it. It has five standing committees, one on science, one on technology, one on STEM education, one on national security and international affairs, and one on environment, natural resources and sustainability. Under those standing committees are many subcommittees. This entity is exceedingly active, and the departments and agencies are stepping up and participating energetically in cooperative efforts to build these interagency initiatives that have to draw on the competencies and the resources of the wide range of agencies that we have engaged. USGRCP, the Global Change Research, Program, for example, has 13 agencies engaged. Similarly, National Nanotechnology Initiative, the Networking and Information Technology R&D Initiative both have large numbers of agencies and they are stepping up. Even in tight budget times, they understand that we cannot afford to ignore these crucial interagency collaborations.

With respect to the private sector and the academic sector, the other part of your question, it is really remarkable and inspiring to me the extent to which private companies and universities are stepping up. Folks from coalitions of private companies and universities are in my office almost every day asking how they can help, how they can do more, and we have engaged them across the range

of these partnerships that I have already mentioned. I think the private sector is particularly interested in being sure, number one, that we maintain the foundation of basic research on which the private sector needs to draw for the research and development of a more applied nature that they primarily undertake. They are also very interested in helping with and helping us maintain our emphasis on STEM education because they are well aware of the need to maintain the pipeline of the next generation of innovators, inventors, makers, discoverers but also the skilled workforce that they need across the board in our high-tech industries in order to continue to compete and succeed.

Ms. WOOLSEY. Thank you, Mr. Chairman. My time is up.

Chairman HALL. The gentlelady's time is expired.

I recognize Mr. Rohrabacher, the gentleman from California, for five minutes.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman.

I am noticing that the Department of Energy in their nuclear program still seems to be focused on light-water reactors, and I would like to ask you your view on that, and it seems that what we have been doing, at least from what I can see from budget requests, that the DOE is basically going from 25 percent of its nuclear energy program aimed at the fact-spectrum reactors and the new high-temperature gas-cooled reactors. We have been spending 25 percent of our research money on those and now it is going down to 15 percent while the spending on light-water reactors, which is essentially old technology, is being increased in the budget requests. Is this a matter of policy coming out of the Administration?

Dr. HOLDREN. Well, let me say first of all that the light-water reactor investments that the DOE is making are not investments in old technology. They are investments in advanced light-water reactor technology including modular light-water reactors, which we think have an enormous potential to contribute not only to energy supply in this country but to a substantial export market.

Mr. ROHRABACHER. Basically it is an old concept but a new approach. Is that a——

Dr. HOLDREN. When you say it is an old concept——

Mr. ROHRABACHER. It is 60, 70 years old.

Dr. HOLDREN [continuing]. Congressman Rohrabacher, with respect, fast-spectrum reactors are also a very old concept and have been explored and deployed for a very long time. We are of the view that if you want nuclear energy to be an expanding contributor to low-emission energy supply in this country in the near future, that is going to happen largely on the basis of advanced light-water reactors, and we need to make sure that succeeds in order to provide a continuing base——

Mr. ROHRABACHER [continuing]. Then will leave us with reactors rather than the new reactors that I am referring to that would somewhat solve the nuclear-waste problem or at least from many scientists are telling us that as compared to the light-water reactors that you are now suggesting that you approve of in that direction. Would they not lead the same nuclear-waste problem that we have?

Dr. HOLDREN. First of all, I approve of light-water reactors of advanced varieties, and the Secretary of Energy does for the next phase. We have a multiphase——

Mr. ROHRABACHER. Would those reactors that are you now approving for the next phase leave us with the same nuclear-waste problem that we have been having so much trouble dealing with?

Dr. HOLDREN. The problem would be the same if we didn't take steps to solve it but——

Mr. ROHRABACHER. Unless we focus on a completely new approach in which 97 percent of the waste is consumed rather than having so much left over.

Dr. HOLDREN. We are, Congressman, focusing on research and development on those new approaches looking for possibilities that would help us——

Mr. ROHRABACHER. You are focusing on it, but you are decreasing the spending on that and increasing the spending on the nuclear program that actually leaves us with the same old problems.

I would like to shift this now, because I only have a couple minutes here. It is very clear in the Appropriations Act of 2011 that we have, that Congress has directed the Administration not to be cooperating on science projects with China. We have the world's human rights abuser, a country that still murders religious believers, a country that its government has mandated a massive technology theft program towards our country and is using that technology that they are stealing with us to try to leapfrog us in a number of technological areas. Are you—is your office complying with this law that is suggesting that you should not be engaged in cooperating with the Chinese on scientific matters?

Dr. HOLDREN. Congressman Rohrabacher, the current law does not say that we should not be cooperating with China. It says that when we do, we must notify the Congress 14 days in advance and assure the Congress that we are not in the course of this cooperation surrendering national security secrets or corporate secrets or dealing with people who are directly involved with human rights violations.

Mr. ROHRABACHER. Well, the GAO doesn't agree with you. I will quote a GAO report. "The plain meaning of Section 1340 is clear. The OSTP may not"—and this is a quote from the GAO here—"may not use its appropriations to participate, collaborate or coordinate bilaterally in any way with China." You are suggesting that the GAO is wrong?

Dr. HOLDREN. The GAO was right at the time it wrote that. That language has been superseded by the subsequent appropriations legislation, which clearly specifies that we may cooperate with China subject to the conditions that I was mentioning, and so we are in complete compliance with the current law on that subject.

Mr. ROHRABACHER. Why is it that you feel, this Administration feels so compelled to reach out to the world's worst human rights abuser that is already in the process of stealing so much from us and who we have examples over and over again that scientific cooperation has turned into a transfer of wealth and technology to our adversary, to what appears to be economic if not military and political adversary?

Dr. HOLDREN. First of all, the Administration is no admirer of the human rights policies in China and when we travel to China for whatever purpose, raise the human rights issues with them. We also raise with them the issue of the theft of intellectual property.

Mr. ROHRABACHER. When you raise issues like that, when you go to China, don't your actions speak louder than your words because you are there to find ways to cooperate with the people who you are now saying we are very concerned about this, now we met that responsibility, so let us go do this.

Dr. HOLDREN. Actually, Congressman Rohrabacher, the point that I make with my interlocutors in China is cooperation in which we are engaged, which is cooperation carefully selected to be beneficial to us as well as to China, is jeopardized by China's human rights abuses and intellectual property theft and that if those activities do not stop, that these beneficial activities, mutually beneficial activities, will not be able to continue. That is an explicit point that I make.

Mr. ROHRABACHER. Thank you very much.

Chairman HALL. I don't think you are going to get the answer that you expected to get, Mr. Rohrabacher. I, too, have seen our President bow and scrape to the enemy on many occasions.

The Chairman recognizes Ms. Bonamici for five minutes.

Ms. BONAMICI. Thank you, Mr. Chairman, and thank you, Dr. Holdren, for your testimony and for the work that you do.

You describe one mission of your office as advising the President on the application of science and technology to matters of national importance. One matter of serious importance in my district and to the Nation more generally is the aftermath of the devastating tsunami that hit Japan last year. The Oregon coast has beaches and a coastline that thrives on tourism and the fishing industry. Oregon is the only State where the entire coastline is public. Three weeks ago, a 66-foot-long dock washed up onto the shore from Japan, and thus far it is the biggest piece to land on our shores, but we have seen an increase in smaller debris. Scientists at NOAA are predicting that more is on the way.

Last week, I held a roundtable discussion to discuss the coordination of efforts to detect, mitigate and clean up the debris resulting from the tsunami. It is an effort that involves multiple federal agencies but also State and local governments and even the public at large. Additionally, the cost of the debris removal is looking certain to stretch the budgets of our State and local governments. But beyond the sheer cost of the debris, the potential for the debris to carry invasive species from Japan such as those that were discovered on the dock poses a challenge to our scientists who have to assess the threat to the marine ecosystems.

The two other federal agencies that have been working on the detection and monitoring from the tsunami are the EPA and NOAA. Considering your office's coordination with federal agencies on science matters and the potential impact of the debris on our coastal ecosystems, where do you see your office fitting in to the response effort at a federal level? Please describe any efforts that you have taken thus far on this issue. Thank you.

Dr. HOLDREN. Thank you for that question. My office is, of course, advisory and analytical more than operational, and so we

try to work with the departments and agencies that have operational responsibilities to be sure that what they are doing is coordinated and consistent with the best understandings of science as we know them. We are in close coordination in that sense with both NOAA and EPA in their responsibilities around the coast including the responsibilities for monitoring and responding to what reaches us from Japan as a result of that devastating tsunami.

We have been particularly engaged in my office in conducting and overseeing assessments of the levels of radioactivity that have reached or could reach the United States, and the reassuring thing I can say about that is that although our ability to monitor is so good that we are able to detect even very tiny concentrations of radioactivity, the radioactivity that has, in fact, reached the United States so far is all in that very tiny category and does not reach levels of public health concern. But we will continue to work with NOAA and EPA to monitor particularly that radioactivity aspect of what reaches our coast, but also other aspects.

I will say that I think NOAA, as with many agencies, has been struggling with 20 pounds of missions in a 10-pound budget, and we all struggle with that challenge today. I think NOAA would tell you, if Administrator Lubchenco were here today, that while they are working very hard at fulfilling these responsibilities, it would be easier to do if they had a little more money.

Ms. BONAMICI. I appreciate that, Dr. Holdren, and I must say that many people around the table understood that this is something unprecedented, and not knowing what and when and where the debris will wash up has been challenging.

In the minute that I have left, would you please discuss some of the work that you are doing on increasing STEM education? We all understand the importance of it, but could you discuss the deficiencies in our skilled workforce and promoting STEM education among young people in this country?

Dr. HOLDREN. Well, I would mention, since time is short, just a couple of things. One is that the President's 2013 budget proposal calls for $3 billion in programs across the government in STEM education, which has a 2.6 percent increase over 2012 enacted, and a considerable part of that investment is in two specific critical aspects of the education system. One is K–12 teacher effectiveness, teacher preparation where we are working very hard to prepare 100,000 new high-quality STEM ed teachers at the K–12 level over the next decade, and the post-secondary STEM education domain is one in which we currently lose about 60 percent of the students who enter college intending to get a STEM degree, only 40 percent who enter do get a STEM degree. And the PCAST, the President's Council and Advisors on Science and Technology, among many others, has studied this question and we conclude that there are two basic reasons for it, both of which we are working to fix. One is the math gap where students enter college without sufficient math preparation to succeed in college-level science, math and engineering courses, and the other is what you might call a teaching effectiveness gap, where the introductory courses in science, engineering and math are often so boring that they drive even very good students into other majors. We have a variety of programs addressed at both of those problems.

Ms. BONAMICI. Thank you very much, and my time is expired.

Chairman HALL. The Chair recognizes Mr. Palazzo, the gentleman from Mississippi, for five minutes.

Mr. PALAZZO. Thank you, Mr. Chairman.

Dr. Holdren, I kind of agree with the comments you have been saying on STEM education, especially in light of the less than 15 percent of Americans actually pursue STEM where other countries such as China, more than 50 percent of their youth are pursuing STEM education, and Mississippi actually recognizes the global implication of this, and through public and private contributions, we just recently opened a $30 million Infinity Science Center with the sole purpose to educate, challenge and excite young people to consider studies in STEM education and it ties in very well with the affiliation with NASA's Stennis Space Center on the role of science and math and exploration across history.

Now, my first question is, as you are probably aware, in order to continue buying seats on the Russian Soyuz spacecraft to ferry U.S. astronauts to the International Space Station and to buy certain engineering services to keep ISS operational, the Iran, North Korea, Syria Nonproliferation Act, commonly called INKSNA, must be extended beyond the current 2016 expiration date. Late last year, the House passed an INKSNA bill enabling our reliance on the Russians through 2020 but the prospects of its enactment would be greatly enhanced if the Administration would put forth a policy statement on INKSNA. Do you anticipate the White House putting out a position statement on INKSNA, and if so, when? And would you agree it would be far, far better to address the issue now versus waiting until the last moment? And given House passage of the bill, I would think the White House would attempt to capitalize on this opportunity.

Dr. HOLDREN. Well, Congressman Palazzo, I agree with the importance of getting a modification to the Iran, North Korea and Syria Nonproliferation Act for the purpose you indicate, and it is clear that that is going to be required. It is clear that sooner is better than later. The Administration has been studying the options for just how to modify it, and we'll certainly be working closely with the Congress to get that issue resolved. I expect that there will be some more specific statement forthcoming in the future but we clearly recognize the need and we recognize that sooner is better than later.

Mr. PALAZZO. In the near future? Can you give a possible timeline?

Dr. HOLDREN. I don't want to put a timeline on it, but I know a lot of attention is going to it in the Administration. It is obviously not mainly my domain, but I expect that there will be a close interaction with the Congress on how to fix this, and it will happen soon.

Mr. PALAZZO. So you will definitely carry back our concerns about sooner better than later?

Dr. HOLDREN. I will carry back that concern. And let me just add, by the way, to your comment on the science center in Mississippi. I have been enormously impressed in my time in this job with the importance of science museums, science centers, and the connectedness of science centers to some of our science-rich agen-

cies and the effectiveness that they have in inspiring kids. I have had my own grandchildren into a number of these centers in different parts of the country, and I can tell you firsthand, it works.

Mr. PALAZZO. Well, they convinced me to buy a brick to help fund it.

A follow-up on Chairman Hall's question where we were discussing NASA's use of Space Act agreements in the Commercial Crew Program. What recourse does the government have if these companies fail to perform or go out of business?

Dr. HOLDREN. Well, of course, there is always a risk in any public or private enterprise that companies will fail to perform. What is happening so far in the commercial space operation is extremely encouraging. The companies involved have met most or all of their milestones. As you know, the SpaceX Falcon 9 rocket and Dragon capsule just pulled off an extraordinary first in docking with the International Space Station, carrying cargo up there and returning to earth bringing cargo and garbage back down. The other competitors are I think close on their heels at meeting their milestones. Obviously, one can never rule out a failure, a shortfall, but so far we are doing well.

Mr. PALAZZO. And last, what, if anything, will NASA own after making these expenditures?

Dr. HOLDREN. The idea is not for NASA to own something. The idea is for the private sector to own something from which NASA can purchase services to carry crew and cargo to the International Space Station. This is basically an increasing privatization of this particular mission of carrying cargo and crew to low earth orbit, and we believe that the efficiencies obtainable from the private sector and from competition in the private sector are going to be a great national benefit in which NASA's investments in the early phases are basically a public investment in a long-term private enterprise that is going to be a great success and that is going to enable us to carry out these missions more efficiently and less expensively but still very safely.

Mr. PALAZZO. Of course, we don't wish any business to go out of business and we want them to succeed, but just say if one does, does NASA obtain the intellectual property or the hardware created to date? And we can wrap up my time.

Dr. HOLDREN. I would have to refer you on that to the legal counsel at NASA. I can't answer details what the fate of intellectual property might be in the contracts.

Mr. PALAZZO. Thank you.

Chairman HALL. Does that give you the answer you wanted?

The Chair recognizes Ms. Edwards from Maryland for five minutes.

Ms. EDWARDS. Thank you, Mr. Chairman, and thank you, Dr. Holdren, for your testimony and your work today.

You know, I know, I have heard from the Administration and from the President and really can see a commitment even in tough fiscal times to the need for our Nation to invest in innovation. It is very clear in the President's speech last week. He talked rather extensively about the importance of investing in basic research and innovation and technology and advanced manufacturing. So I have a question as to how we decide what our priorities are. The Na-

tional Academies comes out with its decadal surveys, and sometimes it seems to me, particularly when it comes to an innovation agenda and especially at NASA, that the recommendations of priorities that the Academies spend an awful lot of time putting together and exploring don't really match the Administration's budgets and the priorities that we then set here in the Congress. And so I wonder if you could tell us how our science priorities are lined up in keeping with recommendations that come out of the surveys.

And then related to that, with respect to the Mars program, it does seem to me that, you know, some time ago fears were expressed at a hearing of this Committee about cuts to planetary science and to Mars missions and those were confirmed by the Administration's budget submission in the 2013 budget request and especially the collaboration between NASA and the European Space Agency ExoMars mission was terminated, and as a result, we won't be participating. We won't participate in the development of the Mars organic molecule analyzer instrument, and it leads me to wonder if the Administration is placing a priority over the long term on this kind of science why our budget recommendations don't line with the priorities.

Dr. HOLDREN. Thank you for that question. The Mars program remains robust, notwithstanding our deciding under serious budget constraints not to proceed with 2016 and 2018 Mars missions that had been under discussion with the European Space Agency. We concluded with respect to those particular missions that there was no way under foreseeable budgets for NASA that our participation in them and in the very expensive follow-on mission that would actually be necessary to return samples, which was the ultimate idea. No way that that was going to be feasible under foreseeable NASA budgets.

The decadal surveys that we get from the National Academy are very valuable. We look at them very closely. In the case of the decadal survey on planetary exploration, while they put a high priority on that flagship set of Mars missions, they also specified what we should do in the event that budgets did not permit carrying through with adequate support for that flagship mission. And in fact, in the fallback position that we developed, we actually followed very closely what the decadal survey said we ought to do if budgetary constraints prevented us doing plan A, and that in general is what we do. We give a lot of weight to those decadal surveys because they represent a huge amount of work by the top level of the wider science community in those domains.

But we have not by any means given up on our leadership in planetary exploration. As I mentioned before, we remain by far the world's leader. We will remain the world's leader in planetary exploration. We have the most complex, largest and most capable planetary rover that ever landed anywhere on its way to Mars, expected to land there in August. We have a follow-on mission called Maven investigating the upper Martial atmosphere to develop knowledge that will be necessary when ultimately we send humans to Mars. We are investigating a number of small and medium-sized Mars missions that could be afforded under the kinds of budgets we have going forward and we have, as I mentioned before, a wide

variety of other planetary and asteroidal probes heading outward or scheduled for launch.

So while we determined that we couldn't afford these particular flagship missions, we very much intend to maintain our commitment to lead in the exploration of Mars and the exploration of the solar system more widely.

Ms. EDWARDS. Thank you. And I will just finish by saying, just leave you with this thought, and for our Committee: You do not science and research by jumping in and out, by not knowing from one year to the next year what your budgets are going to be, and it seems to me that if the Administration and this Congress has a real commitment to science, to research, to advanced manufacturing, to making sure that our students have some place to go if we are encouraging them to engage in STEM, then we darn sure better figure out how to do this from year to year, letting our researchers know what the future looks like, and it is very frustrating, and I know it is frustrating for all of the agencies as well, to do science on a hit-or-miss, year-to-year basis, and it really is unacceptable, and frankly, at the end of the day, it just makes us spend more money. Thank you.

Dr. HOLDREN. I agree, and I would love if it we could——

Chairman HALL. The gentlelady's time has expired. She gives you good advice, and I think she ought to give that advice to the EPA.

Chair now recognizes Mr. Hultgren from Illinois.

Mr. HULTGREN. Thank you, Chairman. And thank you, Dr. Holdren, appreciate you being here.

I just was reading this morning in *Space News* an article about their statement that in the last four years they were arguing that we have gone from first place to probably third place as far as nations in the forefront of space exploration. I think that is a shame.

I want to focus my comments mostly on something else. You were here back in February and I appreciate you coming back today. Following the hearing that we had back in February, I had submitted a couple of questions to you, the answers which I just recently received from your office. One of the questions I asked you in February started by pointing out that particle physics has become a global field that it is now entering an extremely exciting phase and then I asked what you thought what role the United States should play in that. I asked if you thought the United States should be building world-class physics facilities and bringing partners to the United States to collaborate here as the Europeans, Japanese, Italians, and Chinese are all now currently doing in their own countries. Your answer was, "I think the U.S. should continue to play a leadership role in the field as the U.S. is doing even for experiments that are taking place in facilities abroad. I am confident that U.S. researchers can continue to be at the forefront of particle physics and other scientific disciplines."

While I share your enthusiasm for U.S. leadership in these fields, you really didn't answer my question. Not only did you not answer the question, you also seemed to imply that we would be just fine without having any world-class facilities in the United States. That really is troubling to me because—and I want to just ask for clarification on that if I am misunderstanding. And so, very clearly, I

would ask the question, yes or no. Does President Obama believe that we should build large-scale, world-leading physics facilities in the United States as we used to do? Or is he satisfied in spending our scarce research dollars on solar panels and wind turbine subsidies while the next generation of American students is forced to go abroad to study physics?

Dr. HOLDREN. Let me start by saying on the space front I simply do not agree with the *Space News* formulation that the United States has fallen from first to third. By any respectable set of metrics I know of, the United States is still number one in space and intends to stay that way.

On high-energy physics, it is not true that we are content to leave the future of high-energy physics and facilities for doing that to the rest of the world. We support fundamental research broadly and we support research in high-energy physics. The President's 2013 budget has $800 million for research and facilities at the high-energy, high-intensity, and cosmic frontiers, provides funds for new initiative at all three of those. There is an ongoing planning exercise in the Office of High-Energy Physics at the DOE for the development of new facilities at Fermilab in your State and I expect that there will be positive developments coming out of that.

We are not giving up on high-energy physics, although again, we are constrained. Everybody in this room knows the budget challenges under which the government is operating. And within those challenges we intend to continue to invest in cutting-edge, high-energy physics in the United States, as well as in the participation of our scientists in cutting-edge facilities elsewhere when that is where they are.

Mr. HULTGREN. Well, talk is very important but action is even more important. We have seen significant cuts under the President's budget to many of our laboratories, much—significant increase going to some applied science that obviously the President supports. Dr. Holdren, I know you were able to train at MIT and Stanford, both here in the United States. You were also able to teach at Harvard and Berkeley, also here in the United States. You had a lot of opportunities and a very distinguished career. Wouldn't you have thought differently about your own career path if you didn't think there was an opportunity to have such an illustrious and accomplished career and that you had to leave the United States to pursue that career?

Dr. HOLDREN. Well, the short answer is probably yes. If that had been my impression of the state of play, it is possible I would have done something else. But I don't think that is a correct impression of the state of play today. I think the United States remains at the cutting edge of high-energy physics and a great many other fields. You continue to see that in U.S. preeminence in the awards of Nobel Prizes and other prizes, including some that are often awarded for work in the more recent past rather than the distant past. This is a leadership role that we are going to keep and I think we are determined to continue to inspire our young people to believe that there are exciting and rewarding careers in fundamental science in this country.

We still have, by the way, enormous flows of the most talented and brightest students from countries all around the world eager

to study high-energy physics and other topics in our great universities. And I think we are unmatched in the world in terms of the attractiveness of our university system in general and the science focuses in our great research universities in terms of the attractiveness to students from around the world.

Mr. HULTGREN. My time is running out, but I think we all need to ask the question—and, you know, are the President's policies offering today's students the same opportunities your generation of scientists had in terms of training, learning, and working in world-class user facilities here in the United States? I think that is a real question I would say no. The opportunities are not the same. They are not as good. It is declining. Our space program is declining. While others are advancing, ours is declining. We have—I have heard firsthand from physicists in my district that they would certainly think twice about starting a career in a field where they would have no choice but to fly to China, Japan, or Europe all the time to be an active participant.

That attitude of thinking that the President seems to have, the attitude that we shouldn't build facilities here, is a sure way to keep our physics programs from being competitive, not to mention a deterrent to young people to get into those sorts of scientific fields, which I think is a huge failure for our future.

Again, we talked about this ahead of time. I know these are difficult times but that is where difficult and important leadership must step up. And so I hope we can continue to do that through these difficult times, setting that type of vision for our young people that, yes, not only can you study here but you can apply it here because we are going to continue to grow and build new world-class facilities for basic scientific research.

Again, my time is up. I yield back. Thank you.

Chairman HALL. If you asked the question, you did a good job of answering it.

The Chair recognizes Mr. Miller, the gentleman for North Carolina.

Mr. MILLER. Thank you, Mr. Chairman.

An issue that this Committee has dealt with in the last few years is rare earth and energy critical elements. The Investigations and Oversight Subcommittee held hearing—held a hearing after articles appeared in the press I think principally in the *New York Times* about the topic. And unusual for the Oversight Subcommittee, we developed legislation to address the problem that Kathy Dahlkemper introduced in the last Congress and I introduced in this Congress and there has been interest by Republicans on this Committee as well.

Rare earths, of course, are something that most Americans have never heard of, or if they have heard of them, they maybe heard of them in high school chemistry and promptly forgot. But they are increasingly being used in sophisticated technologies and we are at a distinct disadvantage to the Chinese, who largely have a monopoly on many rare earths and energy-critical elements. And they are using those which, in many of the sophisticated technologies, are important to our national security. And they are leveraging their control of those elements to require that manufacturing using those be done in China. To some extent I understand that. I understand

they don't want to have an extractive economy. They don't want to be Angola. But it is certainly not acceptable from our point of view that we are closed out of that important manufacturing that would be a source of jobs, very highly skilled, well-paid jobs for American workers.

But the problem with dealing with it is complex as I am sure you know. There is a variety of suggested programs and it does sound certainly like—it does certainly appear that we need a strong role by our government in coordinating those efforts.

Dr. Holdren, what do you think are the appropriate activities for the government in this area? And what are the notable research gaps?

Dr. HOLDREN. Thank you for that good question. We have been paying a lot of attention to this challenge and the critical materials challenge and the challenge of rare earth minerals in particular. Let me just say as a start that China does not have a monopoly on resources of rare earth minerals, but they currently have a practical monopoly on the whole production system because they were able to undercut everybody else and so everybody else got out of the business. And this is something obviously that we need to fix.

OSTP has been leading an interagency process on how to address the rare earth minerals and related raw materials issues that has involved the Department of Energy, the Department of Commerce, the U.S. Trade Representative, and the Department of Defense. We have created several working groups to address different parts of the problem, including focusing on those resources that are particularly important either to our national security or our economic future. We have hosted roundtables with industry on this subject and looked into what we can do to encourage industry to rebuild some of these supply chains in the United States where we actually have the raw resources but have let the supply chains atrophy. DOE has been pursuing research and development that addresses material separation and processing and reducing the intensity of use of these materials in different applications so that we can make the materials that we do have go further.

In the 2012 appropriation, DOE received $20 million for an innovation hub on critical materials. The 2013 budget requests a continuation of funding for that hub. Both DOE and EPA have announced small business innovation research, SBIR grants addressing processing of these critical materials. We also have an R&D program at DOE aimed at early stage technology alternatives that can reduce or eliminate the dependence we have on minerals that we are not in a position to produce in this country. So we have a lot going on in this domain. We understand its importance. We agree with you about that and we are putting money and resources into remedying the problem.

Mr. MILLER. I yield back.

Chairman HALL. The gentleman yields back.

The Chair recognizes Mrs. Biggert, the gentlelady from Illinois.

Mrs. BIGGERT. Thank you, Mr. Chairman, and thank you for holding this hearing.

Dr. Holdren, the Administration's big data research and development initiative announced earlier this year focused on improving our ability to derive new insights and knowledge from large and

complex collections of scientific and other data. The growth of the big data and data-intensive computing is going to require comparable advances in high end or high performance computing platforms if we are going to effectively and efficiently and affordably extract value from large and growing volumes of data. The power demands alone will limit the development of larger and faster supercomputing systems and their ability to process big data. And I don't view this as an either/or proposition. While the Administration is proposing new financial commitments to big data, we have yet received a report from the Administration on the strategy for achieving exascale computing. And it is my understanding that a report was due out in February of this year outlining the research, development, and engineering efforts to achieve exascale. And again that was due in February. So when can we expect to see it?

Dr. HOLDREN. Let me start by agreeing with your point that the future of computing is going to involve both what we call big iron and big data. And you are asking about the big iron part, the hardware development and the energy requirements. I will have to look into where in the process that exascale computing report is and how soon you can expect it. I will get back to you on that. But I know that we are paying a lot of attention to the needs in that domain and particularly the need that you mentioned to reduce the energy requirements of our fastest computers. And there have been some very important developments in that domain, which promise to substantially reduce the otherwise soaring requirements for power of petaflop computers and more.

Mrs. BIGGERT. I really—I worry about, you know, what is happening in the world and we are just on hold because of a report. But I was pleased to see that the IBM supercomputer at Argonne National Lab in my district ascended to number three as the fastest in the world, third and then behind the fastest computer is at Lawrence Livermore and behind that is a Japanese supercomputer. But I think that all of—the group at Argonne should be proud of their hard work, but clearly, the U.S. leadership is being challenged in this area.

And as one article put it, the latest list marks the return of the European systems in force with the addition of two German systems and one Italian system. And the U.S.-based supercomputer that got the top billing in this latest report is now ranked at number six. And I have certainly been looking at this for a long time and we are facing stiff competition. And the value of supercomputing seems to be globally understood and we can't let us fall behind if we are—and we have to have that plan for achieving exascale and I would urge you to see that it is completing and submitted to the Congress as soon as possible.

Dr. HOLDREN. I agree and I will certainly get back to you on the report. We intend to stay number one. We can expect challenges from around the world in this domain and in others——

Mrs. BIGGERT. Um-hum.

Dr. HOLDREN. In high technology but we intend to stay number one. We recognize the importance of this one.

Mrs. BIGGERT. Yeah. Well, it certainly has been—you know, there is—and now in the 2013 budget there has been a submission for $21 million for new data-intensive science efforts. But the

exascale remains on hold so we have got to get those two to be balanced. Thank you.

Yield back.

Chairman HALL. The Chair recognizes Ms. Lofgren, gentlelady from California.

Ms. LOFGREN. Thank you, Mr. Chairman. And thank you, Dr. Holdren, for being here and for your good work.

Recently, the National Academy of Sciences issued a report titled, "Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories." And I would ask, Mr. Chairman, unanimous consent to submit this report into the record.

The report highlights—and it is a long report but basically it highlights the broken relationship between the National Nuclear Security Agency and the scientists at our research labs. One senior scientist at Los Alamos was quoted in the report as saying this: "when I started as a young post-doc and then later in my career as a university professor and also here at the lab, there was a social contract which basically said you will never get rich in science but we treat you as adults, respect you for your commitment, and in turn you can pursue science and have fun." Today, this contract is badly broken, an atmosphere of distrust, rigorous control, and checks.

And the report went on to note the increasing operational formality of being dictated by the NNSA headquarters that had contributed to a bias against experimental work. And the report said, "without a strong experimental program, the quality of scientific and engineering at the laboratories will be at risk, as will the core mission of these laboratories."

Since this report came out last year, are you aware of anything that NNSA has done to repair the distrust and the damaged relationships that the report outlines both with the directors and with the scientists at our national labs?

Dr. HOLDREN. Thank you for the question. First of all, I am very much aware of the report and——

Ms. LOFGREN. I know you are.

Mr. HOLDREN [continuing]. As you and I have discussed offline, we have a taskforce in OSTP in the National Security and International Affairs division following up on that report's recommendations looking at the health and adequacy of the way we are running our national security, science, technology, and innovation enterprise. I myself just two weeks ago visited both the Sandia National Labs and the Los Alamos National Lab in New Mexico, spoke with the directors of both labs, and I will be going to Livermore to talk to the management at Livermore about this set of problems, among others, and what we can do about them. And I have talked to Secretary Chu about it and with Administrator D'Agostino. And they understand that there is a problem and they are as determined as I am to address it. Obviously, we have to maintain the quality of the science and engineering at our national defense laboratories and excessive micromanagement is obviously not contributing to the attractiveness of continuing employment for our brightest scientists and engineers at these labs. So we are determined to fix that.

Ms. LOFGREN. Thank you very much for that report. That is very encouraging news and perhaps I can follow up offline with some of the details of that. I am so pleased that you are taking responsibility for this issue.

As you know, I am very interested in inertial confinement fusion and I am aware that both you and Dr. Koonin, the former Undersecretary for Science, were instrumental in calling for the report from the National Academy of Sciences to assess our prospects on inertial confinement fusion energy. The National Academy released their interim report, and again, I would ask unanimous consent to put the interim report into the record.

Chairman HALL. Excuse me. This is not a report that has been discussed with the other side. Normally, you know we do that.

Ms. LOFGREN. Oh, I wasn't aware of that, Mr. Chairman, but I——

Chairman HALL. And it would be objection unless you want to work it out with them.

Ms. LOFGREN. It is a National Academy of Science report. It is on the Internet so——

Chairman HALL. I understand it is a very big report and we are aware of it. The normal procedure is to have it worked out, and I think they would probably work with you if you would do it.

Ms. LOFGREN. Okay. That would be fine, be happy to do that.

But I would like to note that the report basically—it is a long report—but it is I would say enthusiastic about the prospects. Originally, the goal for ignition was 2014. Somehow, that morphed into 2012 and as the report—the National Academy report indicates, there is no guarantee. This is science, not engineering. I mean we may get this this year; it may be next year.

Would it be your belief, Dr. Holdren, that we should not—especially given that China and Russia are trying to overtake our lead in this matter that we should not give up, close as we are, on this quest for ignition at this point?

Dr. HOLDREN. Certainly, I agree with that. And Secretary Chu agrees with it, I know. The NIF is a national resource, National Ignition Facility. It has the potential to achieve ignition although there are still obstacles in the way of that. We think that they can be overcome and that they should be overcome. So we remain committed to the use of that facility for that purpose as well as others.

Ms. LOFGREN. My time is up. I would just like to say, Dr. Holdren, it is a delight to have you here and to listen to your wisdom. Thank you very much.

I yield back, Mr. Chairman.

Chairman HALL. The gentlelady yields back.

The Chair recognizes Mr. Brooks, gentleman from Alabama.

Mr. BROOKS. Thank you, Mr. Chairman.

In his State of the Union Address, the President reiterated his call to Congress to pass a "Clean Energy Standard" which would require utilities to produce and sell electricity from expensive sources such as wind and solar. You may also be aware that the Department of Energy has undertaken numerous analyses of the impact of Obama's Clean Energy Standard on electricity prices, including one requested by our own Chairman Hall and another requested by Senator Bingaman. Both Department of Energy studies

found that Obama's Clean Energy Standard would significantly increase electricity prices and result in heavy economic cost to the people of America. Dr. Holdren, do you agree that President Obama's Clean Energy Standard will result in increased electricity cost to American consumers?

Dr. HOLDREN. Well, first of all, let me note that the clean energy standard is not just about wind and solar. It is about nuclear energy, it is about fossil fuel energy with improved emission control technologies, and it is the view of the Administration that we are going to need all of those in increased measure in order to provide the reliable and affordable energy the country needs while addressing the need to reduce emissions, including emissions that are threatening to change global climate, that are changing global climate, which itself——

Mr. BROOKS. Dr. Holdren, please answer my question. Do you agree that the solar and wind aspects of Obama's Clean Energy Standards will increase energy costs for American consumers, as has been determined by the Department of Energy in their studies?

Dr. HOLDREN. Congressman, I have not personally read that study and so I don't want to endorse or criticize its findings without having done so. But we are talking about a portfolio of energy sources that would fall under the clean energy rubric, and my assumption is that that portfolio will be pursued in a way to minimize impacts on energy prices and on American consumers.

Mr. BROOKS. Okay. Do you have a judgment as to whether the solar and wind aspects of Obama's Clean Energy Standards program will increase cost to consumers? You still haven't answered that question. You used the word "minimum." I am asking about will there be an increase? Do you have a judgment?

Dr. HOLDREN. I think the answer depends on a lot of factors that I haven't analyzed. But we know that at the present time both solar energy and wind are more expensive than some of the other options. At the same time, the prices of the other options are changing.

Mr. BROOKS. Are you testifying, then, to this Congress that in your capacity with OSTP you have no judgment, no idea as to whether energy costs will go up or down should the President's Clean Energy Standards with respect to solar and wind power go into effect?

Dr. HOLDREN. The proposal is not with respect to solar and wind power alone. And what happens to prices depends on the portfolio.

Mr. BROOKS. Dr. Holdren, I have limited time. You have already covered that it spans different parts. I have focused my question on the wind and solar part. That is where the focus is. I don't want to go into everything else. I want your judgment if you have a judgment. And if you don't have a judgment, that is fine in your capacity with OSTP. If you have no judgment whatsoever, that is fine. Say so. Do you have a judgment is the first question.

Dr. HOLDREN. I think it depends on what the alternatives are. I think it depends on——

Chairman HALL. Answer the question. He asked if you had a judgment.

Dr. HOLDREN. I do not have a judgment on the question he has posed to me.

Chairman HALL. That answers the question. Go ahead with your questions.

Mr. BROOKS. Thank you, Mr. Chairman. Inasmuch as he doesn't have the background or knowledge to answer that question, I will go to another one.

President Obama has made clean energy spending and the "green jobs" associated with them a centerpiece of his domestic policy agenda. However, as we review and consider the impact of these programs, there has been some controversy regarding the Administration's definition and accounting of what constitutes a "green job." This resulted in many headlines a mere two weeks ago when a senior Labor Department official testified to Congress that the following occupations constitute green jobs under the Administration's definition: college professors teaching environmental courses, school bus drivers regardless of whether the bus is hybrid or an alternative, workers who fuel school buses, employees at bicycle shops, antique dealers because they sell recycled goods, Salvation Army employees, people who sell rare books and manuscripts because the items are used, hence recycled.

Dr. Holdren, as the President's top science and technology advisor, would you agree the Administration's definition of green jobs is flawed and that it overstates a number of true green jobs that exist?

Dr. HOLDREN. The definition as you just described it seems to me to be overly broad, yes. I was not responsible for producing that definition. I would be inclined to ask the Council of Economic Advisors how they would define green jobs. I don't think the Administration as a whole as embraced a decision, but I do agree that the definition you read is overly broad.

Mr. BROOKS. With respect to those seven different professions that the senior Labor Department official testified to Congress constitute green jobs under the Administration's definition, are there any that you would consider to actually in fact be a green job of those seven?

Dr. HOLDREN. I would want to look at that in more detail. You went by the seven rather quickly and I have not focused on this issue.

Mr. BROOKS. Well, would you like me to go through them again or——

Dr. HOLDREN. No, I think that would not be necessary. I would be happy to respond to you in writing following the hearing.

Mr. BROOKS. All right.

Dr. HOLDREN. But this is not a domain in which the Office of Science and Technology Policy has actually gotten involved.

Mr. BROOKS. Well, thank you for your agreement, then, that the senior Labor Department official, his view of what is a green job and the Administration's view of what is a green job differs from yours.

Dr. HOLDREN. His view may not be the Administration's view.

Mr. BROOKS. Chairman, I have no other questions. Well, now, wait a second. This resulted in many headlines two weeks ago when a senior Labor Department official testified to Congress that the following occupations constitute green jobs under the Administration's definition.

Chairman HALL. The gentleman's time is——

Mr. BROOKS. All right. Thank you, Mr. Chairman.

Chairman HALL. You are over.

The Chair recognizes Mr. McNerney. We will get back to that question before we leave.

The Chair recognizes Mr. McNerney.

Mr. MCNERNEY. Thank you, Mr. Chairman.

Dr. Holdren, thank you for joining us today. In your testimony you mentioned a few new projects such as the website about manufacturing databases and the robotics initiative. Would you please discuss how these and other initiatives create jobs locally and how they advance our leadership in the world with regard to innovation?

Dr. HOLDREN. All of the initiatives that we have been pursuing in this domain—advanced manufacturing, robotics, nanotechnology, and others—are aimed, as I mentioned before, at accelerating the transfer of fundamental advances and discovery in science and engineering into commercial processes, products, services, and therefore into economic growth and jobs. And the fact that all of these initiatives are constructed around partnerships with the private sector working together with the public sector and the academic sector is, in fact, leading to success in accelerating the transfer of these initiatives.

We already see signs that manufacturing is moving back to the United States. We are already seeing benefits from this approach. And we are also seeing benefits from an approach in which we are working very closely between industry, government, and community colleges to increase the extent to which the coursework that students take in community colleges prepares them for jobs in the industries that exist in their regions. This I think is an extremely important concept that we have been pursuing and it is already bearing fruit.

One of the striking aspects of our current economic predicament is that in spite of an overall unemployment rate of over eight percent, many high-tech firms cannot find the high skill workers that they need. They can't find the fit between the jobs they actually have open and the people who are available in the unemployed labor force. And we intend to fix that.

Mr. MCNERNEY. Thank you. Well, as we all know, cybersecurity is an issue that is critically important to our national security and our national economic well being. How has your office created initiatives to help the cybersecurity effort and what has the OSTP done to strengthen our national cybersecurity?

Dr. HOLDREN. OSTP has a number of responsibilities in the domain, particularly of national security and emergency preparedness communications. And cybersecurity, therefore, intersects our responsibilities in that domain. But more generally, on cybersecurity we work very closely with the National Security staff, the Homeland Security Staff, the FBI, the National Security Agency, the Department of Homeland Security in an interagency process that is aimed at strengthening cybersecurity across the United States.

We also have a variety of bodies and boards in which these government agencies sit with the CEOs of the major communications internet service providers and the like to build the sort of coopera-

tion that we need between the public and private sector to better protect our electronic systems from attack and from theft. As I think everybody in this room knows, this is an enormous challenge and it is a high priority for the Administration.

Mr. MCNERNEY. Thank you. Well, moving on, then, you know, I am very interested in the STEM education initiatives. Would you please elaborate on how the STEM initiatives you discussed will be utilized in our individual districts?

Dr. HOLDREN. I think going through the individual districts would be——

Mr. MCNERNEY. Well——

Dr. HOLDREN [continuing]. A great challenge. Both Change the Equation and the Educate to Innovate strategy have a specific focus in scaling up models that have proven to work to a much wider variety of locations. So, for example, under the Change the Equation initiative, they have a program to transfer to 100 new sites around the country successful efforts at improving the quality of K–12 classroom education through better teacher preparation. All of these approaches are of course designed to work with educators at the local level because that is where it happens.

Educate to Innovate is, among other things, bringing practicing scientists, engineers, and mathematicians from companies, from national labs, and from universities into classrooms all around the country to work with K–12 teachers in improving the classroom experience through more hands-on activities and also to serve as role models so that the practicing scientists and engineers and mathematicians can relay to the students the excitement and the opportunity available from STEM careers. So we are absolutely trying to do this on the ground across the country and taking models that have worked in particular places and translating them to many more.

Mr. MCNERNEY. Thank you, Dr. Holdren.

I yield back.

Chairman HALL. The gentleman's time is expired.

Chair recognizes Mr. Quayle, gentleman from Arizona.

Mr. QUAYLE. Thank you, Mr. Chairman.

Thank you, Dr. Holdren, for being here. Earlier this week, my colleagues and I sent you a letter seeking additional information on the National Network of Manufacturing Innovation that was included in the Administration's fiscal year 2013 budget request. And NIST has been tasked with coordinating this interagency effort. The original budget justification stated that the Administration would propose legislation creating a mandatory account making available $1 billion but really few details have been made available. Now, my Subcommittee has subsequently held two hearings with NIST on their fiscal year 2013 budget request and another specifically on the NNMI proposal. And we have been really frustrated by the lack of information and the inability to receive answers on basic questions about the proposal's funding and structure. We have been told that the Administration is leading this initiative, so I would like to follow up directly with you.

And my first question is how did the Administration arrive at the funding level of $1 billion for the greater network?

Dr. HOLDREN. Well, the basic answer to that question is we expect, number one, that the $1 billion from the Federal Government over a period of five years will stimulate at least matching contributions from the private and philanthropic sector. So we are looking at a program which over five years would spend about $2 billion in total. And the idea is to have 15 institutes for manufacturing innovation around the country which would spend about $30 million a year each. So that is $450 million a year times five years is $2.25 billion. And basically that is where the $1 billion number came from. The government——

Mr. QUAYLE. Where did the estimates for the spending for each of those different institutes come from? I mean how are you basing those estimates? I am just trying to get an understanding.

Dr. HOLDREN. I mean obviously it is a back-of-the-envelope calculation——

Mr. QUAYLE. Right.

Dr. HOLDREN [continuing]. Designed to estimate about how much money it would take to make a dent in a regional institute with this focus. But, you know, I could not produce a sharp enough pencil to tell you that $30 million is exactly the right number——

Mr. QUAYLE. Right.

Dr. HOLDREN [continuing]. Rather than $25 or $35.

Mr. QUAYLE. Okay.

Dr. HOLDREN. So it is a ballpark number that takes you to the ballpark number of a billion dollars from the government.

Mr. QUAYLE. Okay. Now, the proposal states that it is a mandatory account which is interesting because most of the times these programs are discretionary. But the proposal states that it is a mandatory account and the authorizing legislation would be subject to PAYGO. Can you tell us the specific offsets that the Administration has identified for establishing this mandatory fund?

Dr. HOLDREN. No specific offset has been identified to this program. It is offset within the mandatory policy changes proposed in the budget, but we have not tried to offset the program explicitly.

Mr. QUAYLE. Okay. And then on March 9 of this year, the President held a public event in Virginia where he announced the creation of a pilot program supported by up to $45 million in fiscal year 2012 funds drawn from existing resources in multiple agencies, including some within this Committee's jurisdiction. NIST, NSF, and the DOE more recently we heard that NASA will also be participating in the pilot program. Can you tell us specifically what activities at NIST, NASA, NSF, and DOE are going to be reduced in order to fund the pilot program?

Dr. HOLDREN. I don't think any activities are going to be reduced. The agencies that are going to collaborate in the additive manufacturing pilot are advancing specific missions that they are already authorized to pursue and they are undertaking activities for which funds have been appropriated. But they are doing it under this overarching rubric.

Mr. QUAYLE. So were the funds not necessary—did—are we overly funding these programs? Because it seems like we are actually extending and expanding what they are supposed to be doing by putting this additional money into new programs. Did they not need that money before and it was just excess?

Dr. HOLDREN. I think we are improving efficiency and coordination by focusing these efforts under this rubric.

Mr. QUAYLE. Okay. Now, one other quick question is why would the Administration propose to fund the NNMI in fiscal year 2013 when the pilot, which is supposed to serve as proof of concept for the greater network—and that won't be completed until at least the end of fiscal year 2014—why the discrepancy there when you are asking for the funds in fiscal year 2013 when you are actually not even going to get proof of concept until the end of fiscal year 2014? It seems like you are putting the cart before the horse here.

Dr. HOLDREN. Well, actually, the solicitation for the additive manufacturing pilot closed last week. We expect to announce an award in the coming month to six weeks, and we therefore expect that the pilot would begin to operate before the end of fiscal 2012.

Mr. QUAYLE. But operation isn't proof of concept. I mean you can have an operation and say that you are going to try to prove a concept——

Dr. HOLDREN. No, the proof of——

Mr. QUAYLE. You are going to be spending a billion dollars; you would think that we would want to put forth the proof of concept in the totality, not just, hey, we have started the process of a proof of concept, which seems what you are doing then if you are talking about those awards. That is not a proof of concept; that is just the beginning of that process.

Dr. HOLDREN. Well, I think we are talking about a phased process, and we think that the order we have laid out makes sense.

Mr. QUAYLE. Okay. Thank you, Dr. Holdren.

I yield back.

Chairman HALL. The gentleman yields back.

The Chair recognizes Ms. Johnson from Texas for five minutes.

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

Dr. Holdren, I know that in terms of staffing, the OSTP experiences a high turnover both during the transition in leadership and throughout any given administration because of your heavy reliance on detailees from the agencies. But your day-to-day coordination duties carry on from one year to another and from one administration to another. So how many OSTP staff tend to carry over from one administration to the next or at least what are your own—what is your experience in it?

Dr. HOLDREN. Well, of course, there is continuing turnover in these positions. When I took over the office upon my confirmation by the Senate in March of 2009, there were 40 some people who had stayed from the previous administration. The turnover in that group proceeded over the intervening three years and there are now probably more like 10 or 12 who have carried over from the previous administration. The continuity is obtained in a lot of ways, partly as the folks who are carried over, partly is the really extraordinary performance of OSTP directors from one administration to another in handing over to their successor an extraordinary degree of documentation about the activities and responsibilities of the office. I got a tremendous amount of valuable information from my predecessor, the late John Marburger, who served in this capacity in the Bush Administration, who in turn got a tremendous amount from his predecessors in the Clinton Administration.

There is also a continuity that comes from people coming in and out. That is, I was in and out of OSTP throughout the Clinton Administration in my role as one of President's Council of Advisors on Science and Technology. So I actually knew quite a bit about what goes on in OSTP before I ever got the job. There are other folks who have been in OSTP before and are now back again but weren't carried over from the previous Administration. There are a lot of ways we deal with continuity but I think we are doing well.

Ms. JOHNSON. The benefits—I know there are benefits and limitations of this current model, but I think what it does emphasize is that outcomes are not necessarily partisan; they are strictly based upon——

Dr. HOLDREN. Yes. I mean we think of science and technology policy as a domain that has largely been bipartisan over the years. I think it continues to be. There is wide bipartisan support for at least most of what we do and we don't think of ourselves as a partisan office.

Ms. JOHNSON. Does your budget adequately support the mix of staff and that you think might be best or do you get too much?

Dr. HOLDREN. Well, of course, we took a 32 percent budget cut for fiscal year 2012. Unfortunately that caused a lot of stress and a lot of challenges to manage OSTP's wide range of responsibilities with a budget cut of that magnitude. We are pleased that the appropriators both in the House and in the Senate have this year voted out the President's full request of $5.85 million as opposed to the $4.5 we got in 2012 and we hope that ends up, obviously, in the final appropriations bill. It would put us in a much better position to cover the range of responsibilities we have. We really do a lot on a shoestring and we do it in part, as your question implies, with the help of a lot of detailees who come from the science reg agencies, they come from NSF, NOAA, NASA, DOE, DOD, NIH, and they bring insights about those domains and they enable us to cover the broad terrain in a way that we would not be able to cover if we had to do it all on our own budget.

Ms. JOHNSON. Now, one last quick question. The current statute limits the office to four Associate Directors and makes them subject to Senate confirmation. And right now, you are taking advantage of all four slots but unfortunately all without any Senate-confirmed directors. Do you have any thoughts either on the number of directors or the requirement for Senate confirmation?

Dr. HOLDREN. Well, I think four Senate-confirmed Associate Directors correspond to the four divisions—Science, Technology, Environment and Energy, and National Security and International Affairs is the right number. We started out after some delays in confirmation having three of the four Senate-confirmed. The fourth, the President's nominee for National Security and International Affairs, was never confirmed. He got an interim appointment that subsequently that expired and so he has left. But in the meantime, the Senate-confirmed Associate Director for Technology Aneesh Chopra has left just a few months ago. The Senate-confirmed Associate Director for Environment and Energy Shere Abbott left a little longer ago. And the Senate-confirmed Associate Director for Science, Dr. Carl Wieman, Nobel Laureate in Physics left just a couple of weeks ago for personal reasons—health reasons really.

And so we are currently in a position very late in the term, when the prospects of getting additional nominees through the Senate are very poor, we have one nominee, the President's nominee for an Associate Director for National Security and International Affairs, Dr. Pat Falcone, has had her hearing and we hope she will be confirmed. But the other divisions are currently under strong leadership but leadership that I have delegated the responsibilities to on an interim basis. And I think it is—while we are working on the problem of finding people who would be Senate confirmed for those slots, I am not sure how many of those we will be able to get confirmed before the election.

Ms. JOHNSON. And it is even more of a challenge for the Nation.

Thank you very much. My time has expired.

Chairman HALL. The Chair recognizes Dr. Harris, gentleman from Maryland, for five minutes.

Mr. HARRIS. Thank you very much, Mr. Chairman.

And thank you, Dr. Holdren, for appearing in front of the Committee.

Let me ask, you know, one of the issues that came up before my Subcommittee has to do with transparency, and in your testimony, you kind of brag about the first day in office the President signing the memorandum on transparency and open government. With that in mind, as the President's Science Advisor, do you think it is a matter of principle that the Federal Government should make scientific data that it uses to justify regulatory actions public? Specifically, we have an issue with the EPA and some of their regulatory actions that they claim are based on scientific data but we have had a hard time getting them to release the original data upon which they base action. As a matter of principle, do you think we should expect that?

Dr. HOLDREN. Yes.

Mr. HARRIS. Okay. Would you work with the Committee to see that we get——

Dr. HOLDREN. Be happy to do that. If there is a problem there, I would happy to work with you. I think the principle is—absolutely the data on which regulatory decisions and other decisions are based should be available to the Committee and should be made public unless there is a classification reason——

Mr. HARRIS. Right, and——

Dr. HOLDREN [continuing]. It seems unlikely.

Mr. HARRIS [continuing]. I imagine unlikely in that situation.

Dr. HOLDREN. Unlikely in this case.

Mr. HARRIS. Well, thank you. Let me ask you, also in your testimony you talk about clean energy but when the President talked about clean energy in the State of the Union, he actually included natural gas as clean energy. You left it out of your testimony. Do you consider natural gas a clean energy source?

Dr. HOLDREN. Yes. On that——

Mr. HARRIS. Okay. Is there a reason——

Dr. HOLDREN [continuing]. Natural gas——

Mr. HARRIS [continuing]. Why you left it out of your testimony?

Dr. HOLDREN. No. Natural gas is the cleanest of the fossil fuel resources——

Mr. HARRIS. So you think we should have——

Dr. HOLDREN [continuing]. Inherently——

Mr. HARRIS [continuing]. Significant research and development into it as a clean energy source?

Dr. HOLDREN. Well, I think the natural gas business is so well developed that the private sector does most of the further R&D that is needed in that domain. I don't think we need a large federal R&D program, although we do need federal R&D to ensure, for example, that hydrofracturing can be done in a way that protects drinking water and protects other environmental values.

Mr. HARRIS. Is there—you are a scientist. Is there a documented case of contamination of drinking water from hydrofracturing?

Dr. HOLDREN. There is not.

Mr. HARRIS. There is not. So as a scientist with 1.2 million applications of hydrofracturing, your testimony is that despite 1.2 million applications with no case of drinking water contamination, we should be expending monies in the Federal Government for 10 agencies to look for a reason to regulate hydrofracturing?

Dr. HOLDREN. We are——

Mr. HARRIS. As a scientist now, 1.2 million applications, Doctor, you admit no documented case of drinking water contamination. Now, to me it looks like—that looks like a wild goose chase, but you might have a different opinion.

Dr. HOLDREN. I think it is very important that we develop hydrofracking in a way that the American public has confidence in it and can continue to rely on it.

Mr. HARRIS. Do you think that——

Dr. HOLDREN. I think the danger is, Congressman——

Mr. HARRIS. Dr. Holdren, I am going to interrupt you for a second because I only have two more minutes and I have one more question. Do you think it is scientifically—that it is scientific integrity when the EPA issues a press release, a fear-mongering press release about the data from Pavillion study and basically has to go back and admit a few months later that we have to actually go back and collect some more data? Do you think that is good science?

Dr. HOLDREN. I don't want to defend a particular press release.

Mr. HARRIS. Okay——

Dr. HOLDREN. I didn't see it.

Mr. HARRIS [continuing]. Dr. Holdren, I would suggest that part of the reason why the American public has no faith is that the scientific community in this Administration has not come out and said you know what? You ought to have confidence in a technique that has been used 1.2 million times with no documented case of water—now, we are going to look at it, but as a baseline it looks pretty safe. It is exactly 180 degrees from what scientists in the Administration have said.

Now, finally, in my final minute, there is a conference going on in Rio de Janeiro this week, and Americans quite appropriately are pretty skeptical whenever we get together at international conferences and come to agreements because they are concerned that our taxpayers are going to bear the costs and economic burdens of any agreements that come from these.

In 2007, at a Climate Change Conference in Bali, your response to an interview question asked about whether "Americans need to

reduce their living standards," you said—and this is a quote and I need to know whether it is accurate—"there is going to have be a degree of redistribution of how much we consume." Is that an accurate quote of what you said in 2007?

Dr. HOLDREN. I do not remember, sir, exactly what I said in 2007, but it sounds to me that I would have been talking about distribution between clean energy technologies and dirty energy technologies and where we get our consumption, what the processes are more broadly by which we support our standard of living.

Let me note as well that both the President has said, and I have said, that we believe that the country's natural gas resources can be developed safely. We have both been clear on that. The question that you are getting at is whether the government needs to pay any attention at all to the range of potential environmental——

Mr. HARRIS. No, the question—my specific question is whether you said there is going to have to be a redistribution of how much we consume. And I will go back and pull the final quote whether we were talking about energy or whether we are talking about this perception that the government just thinks that Americans just consume too much and that maybe this is not fair somehow. Well, I would suggest that we—you know, if you think that what we ought to reduce our GDP, consume less, maybe have a lower GDP, that is certainly consistent with the President's economic policies.

Dr. HOLDREN. That is not——

Mr. HARRIS. We are at the——

Dr. HOLDREN [continuing]. What I think and it is not what the President thinks.

Mr. HARRIS. Well, thank—I am glad he doesn't think it but, you know, when they continually revise down our GDP estimate and then we have folks in the Administration who have said a few years ago, well, you know, we ought to redistribute our consumption and you have other Administration officials say, well, you know, it would be nice if the price of gas were at European energy gas levels, then some people are skeptical of that. But with that—and that was just a rhetorical question. I thank you, Mr. Chairman.

Chairman HALL. The gentleman yields back.

The Chair recognizes Mr. Lipinski, the gentleman from Illinois, for five minutes.

Mr. LIPINSKI. Thank you, Mr. Chairman.

Thank you, Dr. Holdren, for your testimony and for all the work that you are doing. I know it has been almost two hours now. A couple questions that I have here, the first is the *America COMPETES Act* and the reauthorization, I think, were very, very critical for our Nation and we need to remain committed to those. I am particularly interested in talking with you about innovation inducement prizes at federal agencies. OSTP recently released a report on prizes highlighting successes and best practices in federal prize programs. I was glad to see this report, and I am glad that you support the use of innovation prizes. Something I had originally been a part of is the creation of the H–Prize for hydrogen. I have continued to promote the use of innovation prizes.

So can you update us on what has been done with the prizes authority so far in 2012 and what OSTP is doing to promote the use of prizes at agencies like the National Science Foundation?

Dr. HOLDREN. Well, thank you for that question. First of all, we have issued a memorandum that went to all the departments and agencies making clear that they had the authority to use prize competitions to achieve the goals of the departments and agencies where that made sense. And we think—and I think you agree from your own background in this domain—that prizes and competitions are often an extremely efficient way to generate innovation because you end up only paying for success. You describe a goal but don't prescribe the ways to get there, and you draw on the innovation of a very wide—or the creativity of a very wide community to find the innovations.

We now have prize competitions going on in something like 40 different departments and agencies, including the NSF, including the DOD, the VA, the Department of Transportation, and many others. And the ones that have already come to completion have shown some quite remarkable results. I mean one that I am sure you know about is the Automotive X Prize, which was corporate money but DOE orchestration of the prize competition. There was $10 million in prizes for folks who could construct and demonstrate a vehicle that gets more than 100 miles per gallon equivalent fuel economy. And three vehicles succeeded and split the prize money, but the interesting thing is the competitors invested $100 million in pursuit of $10 million in prizes. I call that leverage.

Mr. LIPINSKI. And I thank you for that, and I think we both agree that it is certainly not a substitute for research grants but another way of trying to promote innovation in our country.

A couple other things I wanted to touch on that were brought up earlier. First, very briefly I want to concur with Ms. Lofgren on the NIF and I am also very interested in NIF and what we are going to do in the continuation of that. And STEM education, as Co-Chair of the STEM Ed. Caucus, one thing particularly that I wanted to raise with you is the federal investment in formal science education, which has shrunk in recent years, and this year's NSF budget request, for example, included 22 percent reduction in Advancing Informal STEM Learning grant program. So I just want to ask do you expect informal education programs, including grant programs, to be an important part of future federal STEM education portfolio or are we going to continue to see this going down?

Dr. HOLDREN. No, I think it will continue to be an important part. We are in the late stages of producing a STEM Education Strategic Plan that draws on the results of the inventory I mentioned before where, for the first time, we conducted a comprehensive inventory of all the Federal Government STEM ed. programs across all departments and agencies that do these things. We are already benefitting from some of the insights from that inventory in finding ways to expand programs that are more cost-effective and shrink some of those that are less cost-effective. But I would certainly not expect the informal education programs to go away. I think when the STEM Education Strategic Plan comes out fairly shortly, those programs will continue to have a role.

Mr. LIPINSKI. Well, I certainly encourage you to continue including informal STEM ed. I know how important that was for me personally and for a lot of others and I look forward to seeing the federal STEM Education Strategic Plan later this year. Anything else you could tell—anything more specific about when this may come out or anything else you could tell us about that plan very briefly?

Dr. HOLDREN. I believe that STEM Education Strategic Plan will be out by fall.

Mr. LIPINSKI. Thank you.

I yield back.

Chairman HALL. The gentleman yields back.

I thank Dr. Holdren for your testimony. And we may have other questions. I have some questions I will submit in writing and get them to you and hope within a couple of weeks we can leave the record open for that.

And to Ms. Lofgren, it is my understanding that they have an agreement on the content of her request, and without objection, her request is granted.

[The information may be found in Appendix 2.]

Chairman HALL. And with that, Doctor, you are excused.

This hearing is adjourned. We are adjourned.

[Whereupon, at 11:52 a.m., the Committee was adjourned.]

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

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

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m.

QUESTIONS FOR DR. HOLDREN:

1. Both House and Senate appropriators have provided OSTP with the budget request amount of $5.85 million (23 percent increase) in their respective FY 13 bills. Should this amount stand, and with funding for your office restored, will OSTP resume the responsibility for funding of PCAST activities?

   If the Office of Science keeps this responsibility, will this take much needed funding away from the agency's basic research priorities? How will OSTP use the additional funding that is no longer being put towards the administrative costs of PCAST?

   How does having a mission agency fund PCAST affect the outcomes of its work product? Does it create the potential for a perceived bias on energy issues at the expense of the other federal agencies?

   Consistent with Executive Order 13539, as amended in December 2011 by Executive Order 13596 from December 2011, the Department of Energy (DOE) will continue to provide funding and support for PCAST in 2013.

   Though the funding, administrative, and technical support functions for PCAST were transferred from OSTP to DOE in December 2011, OSTP continues to exercise policy and programmatic oversight of PCAST through my role as co-chair and through PCAST's staff, who continue to be housed at OSTP. The transfer from OSTP to DOE will not result in any changes in PCAST agendas or advice, nor will it result in any perceived or real bias in PCAST: PCAST has been, and will remain, a group of independent, presidentially-appointed scientists and engineers from the non-Federal U.S. science and engineering community. PCAST will continue to offer independent advice to the President and the Federal government on topics requested by the President and the Administration. We do not anticipate any impact on DOE's basic research priorities from DOE's support of PCAST.

   PCAST's funding level at DOE is expected to be comparable to PCAST's historic funding levels at OSTP. Although the 2013 Budget request for OSTP represents an increase compared to the 2012 appropriation, the OSTP 2013 request of $5.85 million is well below the $6.647 million OSTP 2011 appropriation because of the approximately $0.8 million in PCAST-related funding that is no longer part of the OSTP budget.

2. I understand one of your goals for the Strategic and Economic Dialogue and the Dialogue on Innovation Policy meetings in May was to raise with the Chinese their practices on intellectual property theft, including economic espionage and cyber theft. Can you update us on how that

meeting went and what you were able to achieve in your conversations with the Chinese?

At the 2012 Strategic and Economic Dialogue (S&ED), I reported out at the Economic Track meeting, led by Treasury Secretary Geithner, on the progress thus far of the Dialogue on Innovation Policy (Innovation Dialogue), which I chair with Chinese Minister of Science and Technology Wan Gang. At the Innovation Dialogue, which met one day before the formal start of the S&ED, we made steady progress in addressing innovation policies in China, with a focus on discriminatory and counterproductive actions that discourage innovation. We heard from nongovernmental experts groups on their views and on their studies of discriminatory practices and policies that hinder innovation. One major success of the May meeting was a commitment from China to treat intellectual property rights (IPR) owned or developed in other countries the same as IPR owned or developed in China. This commitment will help to ensure that U.S. companies are not discriminated against based on where their IPR is developed or owned in government or commercial contracts.

3. The Senate proposed to transfer weather satellite acquisition from NOAA to NASA. Will this result in cost savings? Will this result in efficiencies or streamlined management? Will this increase the likelihood of the program's success by meeting mission requirements on schedule and within budget? Why has the Administration been silent, and can we expect the Administration to take a position on this major policy change? If so, when will this happen?

We are still developing a response to the Senate Commerce-Justice-Science (CJS) Subcommittee's proposal to move weather satellite acquisition from NOAA to NASA. As you know, the management of these satellite programs is a complicated issue which the Congress and the Executive Branch have been grappling with for years. We are analyzing the possible impacts the Committee's proposed organizational change could have on the Joint Polar Satellite System (JPSS) and Geostationary Operational Environmental Satellites (GOES) program missions and other satellite programs, as well as on satellite budgets, schedules, and risks.

4. Since NPOESS was disbanded, who is in charge of ensuring the health of the entire polar orbiting constellation (afternoon orbit – NASA/NOAA and morning orbit – DOD)? Also, who is responsible for coordinating the requirements between agencies and with international partners?

While NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) coordinates with DoD and NASA and their international partners, OSTP is ultimately responsible for ensuring that this coordination is adequate to the task of ensuring the health of the entire polar-orbiting constellation.

The JPSS Director at NOAA is collaborating with the Air Force as it develops its weather satellite follow-on program, which is still in the early phases. NOAA continues to operate the DoD Defense Meteorological Satellite Program (DMSP) on a reimbursable basis from the NOAA Satellite Operations Facility in Suitland, MD.

NOAA NESDIS coordinates on requirements and operations of meteorological environmental satellites through the Coordination Group for Meteorological Satellites (CGMS), a part of the World Meteorological Organization, and through the Committee on Earth Observing Satellites (CEOS), an international organization of 52 members and associate members made up of space agencies, national, and international organizations.

NESDIS works with users of NOAA satellite data through a number of coordination mechanisms, including the U.S. Group on Earth Observation (USGEO), the National Earth Observation Task Force, and the Environmental Satellite Users Group, among others.

5. As the President's Science Advisor, do you support construction of new coal-fired power plants in the absence of significant carbon controls?

The Administration has been implementing an "all of the above" energy strategy that includes use of clean coal and natural gas. We are implementing an aggressive R&D program on advanced coal technologies with a goal of developing coal-based technologies that can produce cost-effective electricity at a competitive price while meeting ambitious emission-reduction goals. The Environmental Protection Agency recently proposed an emission standard for new fossil-fuel fired electric plants larger than 25 electrical megawatts that would require all such plants to produce no more carbon dioxide per unit of electricity generated than widely used natural-gas combined-cycle technologies. New coal-fired units could meet the standard either by using carbon capture and storage (CCS) technologies that would capture about half of the carbon dioxide emitted by such plants at startup, or through later application of more effective CCS to meet the standard, on average, over a 30- year period.

6. DOE's coal research activities are almost exclusively focused on developing carbon capture and sequestration technology, the goal of which is to limit the increase in the cost of electricity to 35 percent above the traditional pulverized coal power plants. What is the Administration, including DOE, doing to lower the cost of coal-fired electricity?

The DOE coal research program is focused on reducing the cost of clean coal-fired electricity while meeting emissions-reduction targets. EPA and Energy Information Administration analyses prepared in 2010 showed that, if available on a cost-effective basis, under some conditions carbon capture utilization and storage technology (CCUS) can, over time, play a role in reducing the overall cost of meeting domestic emissions reduction targets.

7. At a Committee hearing in May, the Department of Energy testified that developing America's vast supplies of oil shale and oil sands was indeed part of the President's all-of-the-above strategy, but that no funds were requested in the budget to support R&D in these promising areas. Can you explain why the Administration is proposing to zero out funding for these vast energy resources that could become a major contributor to U.S. energy independence goals, if we only invest in the needed R&D?

In the President's FY2013 budget, the Department of Energy's Natural Gas and Unconventional Fossil Energy R&D programs are reprioritized to launch a collaborative research and development initiative together with the Environmental Protection Agency and the Department of the Interior's U.S. Geological Survey to understand and minimize the potential environmental, health, and safety impacts of natural gas development through hydraulic fracturing, targeting the high-priority recommendations of the Secretary of Energy Advisory Board's August 2011 "Shale Gas Production Subcommittee Ninety-Day Report." The Department of Energy's role in this initiative focuses on priorities identified by the interagency collaboration in a research plan, currently under development, within its area of core research competencies, including wellbore integrity, flow and control; green technologies; and systems engineering, imaging and materials. While this R&D is focused

on addressing issues surrounding shale gas, many of the environmental mitigation efforts that the Department of Energy is pursuing are also applicable to shale oil production.

Questions for the Record
The Honorable Eddie Bernice Johnson, Ranking Member

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m.

QUESTIONS FOR DR. HOLDREN:

1. As you mentioned in your written testimony, OSTP has been working on the issue of public access to federal research results for some time. In response to a COMPETES requirement, you convened separate NSTC working groups to examine access to digital data and scholarly publications, issued requests for public comment, and in March sent to Congress a report on those efforts. I was disappointed that the report did not include any substantive guidance on what sustainable federal public access policies might look like or any discussion about the timeline or process by which such policies might reasonably be developed. I believe that greater access to scientific data and publications will happen over time whether we act or not. But there are many ways to go about it, some likely more suitable than others for maximizing opportunities for interoperability and ensuring long-term integrity and stewardship of the archives of scientific work. What are your plans on this topic moving forward? Specifically, what is the Administration's timetable for developing and announcing a concrete federal approach to public access?

   I wholeheartedly agree that, in general, science is moving quickly towards wider public access to the results of scientific research. I also agree that it is important to consider the many complexities of broadening public access, including addressing interoperability and longevity. We at OSTP appreciate your patience as we navigate the often contentious issues around public access to scholarly publications. We continue to analyze opportunities and approaches for increasing public access; ensuring interoperability and longevity of systems and information; and providing for economic growth. We are working with Federal agencies and the private sector to find equitable solutions. Unfortunately, I cannot give you a precise timetable for completing these negotiations and announcing policies.

2. During the hearing there was some discussion about U.S. leadership in 'big science.' In particular, a Member of the Committee expressed concern that the Administration is willingly giving up leadership in high-energy physics and that we risk losing top American students and scientists to foreign institutions as a result. How is the United States positioning itself to maintain a leadership role in high-energy physics and other 'big science' fields? What, if anything, do we give up by participating in international projects on foreign soil, such as the Large Hadron Collider, rather than hosting such multi-billion dollar projects in the U.S.? What do we gain, or at least, what don't we lose? Finally, what are we doing to ensure that top American talent in these fields remains at U.S. institutions?

   The Department of Energy's Office of Science is a global leader—and the leading U.S. agency—in supporting scientific user facilities, the large-scale tools necessary to advance "big science" fields. The Office of Science's national scientific user facilities provide researchers with the most advanced tools of modern science including accelerators,

colliders, supercomputers, light sources and neutron sources, as well as facilities for studying the nanoworld, the environment, and the atmosphere. In Fiscal Year 2011 over 26,500 researchers from academia, industry, and government laboratories utilized these unique facilities to perform scientific research.

The Office of Science is committed to sustaining U.S. leadership in each of its core research programs, including the "big science" fields of high energy physics and nuclear physics. Although the FY 2013 budget requests for Nuclear Physics (NP) and High Energy Physics (HEP) include difficult trade-offs, each also makes investments in sustaining U.S. leadership. The NP request provides sufficient funding, equal to the level of support for FY 2012, for continued planning of the Facility for Rare Isotope Beams (FRIB) project and keeps the 12 GeV upgrade to the Continuous Electron Beam Accelerator Facility (CEBAF) on track. In the specific case of high energy physics, the Office of Science's High Energy Physics (HEP) program maintains a rich, diverse research portfolio spanning the Energy, Intensity, and Cosmic Frontiers. HEP is in the process of evaluating its future priorities to develop a program that continues to support world-leading science and is consistent with the constrained fiscal environment.

High energy physics and nuclear physics are highly internationalized disciplines with scientists from many countries participating in experiments all over the world. Through US participation in the Large Hadron Collider experiments, US Energy Frontier investments are highly leveraged, yielding world-class research conducted by US scientists. By maintaining forefront facilities in the US that are open to foreign participation and by supporting US participation in forefront facilities abroad, we are ensuring that US scientists have the best opportunities to pursue world-leading research across a broad diversity of fields.

3. Economics has a simple concept called "substitute goods." Most undergraduates learn about this in Econ 101. In the energy plan put forward by the Administration, broad goals for a host of cleaner energy sources are laid out for the Nation. In this plan, isn't it true that solar, wind, hydropower, biomass, geothermal, nuclear, municipal solid waste, and other forms of fossil fuels meeting certain production requirements can qualify as "clean," and they are, in fact, substitutes for one another? Would it be a mistake to isolate one or two of these substitute sources of power in trying to analyze the overall cost effects of this plan? If so, why?

Many types of energy in a flexible mix will meet America's energy needs in the Administration's clean-energy proposals. The President has consistently supported market-based approaches to environmental issues, and recently proposed a Clean Energy Standard (CES) to keep our energy supply clean, affordable, and secure. A CES is a flexible, market-based approach with annual targets for electricity from diverse, domestic sources, including renewable energy, nuclear power, efficient natural gas, and clean coal. A CES would enable businesses and entrepreneurs to determine the best way to achieve the targets, ensuring that clean energy is produced wherever and however it makes the most economic sense. Depending on market and technological conditions at any given time, one cleaner energy source could substitute for another energy source because a CES does not dictate specific targets for solar, wind, etc.

The Energy Information Administration has analyzed Senator Bingaman's proposed legislation that would establish CES using its National Energy Modeling System (NEMS). NEMS is a macroeconomic model that determines electricity costs based on a least-cost

supply mix, which is obtained by the use of the supply curves, emissions factors, and intermittency constraints for all the competing sources of electricity. In such analysis, it is not feasible to determine the isolated effects of a policy on a single generating source.

4. It is my understanding that technological innovation can impact the efficiency of energy production from various sources of electricity generation. Would it make sense to invest in improving the efficiency of electrical generation sources in those areas where private firms are not sufficiently capable of making such investments themselves?

Yes, in many cases it does make sense for the Federal government to invest in energy innovation in areas where private firms are not making investments that would have a substantial public payoff. While a Clean Energy Standard will ultimately require Congressional legislation, the FY 2013 Budget advances CES goals by increasing funding for renewable energy research and development, spurring advances in fossil-energy technologies that reduce carbon emissions from coal-fired power plants, supporting nuclear energy, and promoting the expansion and use of clean energy across the country, including in rural areas. Many of these long-term investments are aimed at enabling electricity generation to be cleaner and more efficient. The President believes that targeted and sustained investments in clean energy research and development that can jumpstart private-sector innovation are critical to our long-term economic growth, energy security, and international competitiveness.

5. Could you provide a broad overview of the range of investments the Administration is making in technologies that could be game-changing in terms of the cost of electricity production from various sources? Please also include energy storage and transmission technologies that could have implications for the competitive position of various generation technologies.

To unleash American innovation, the Administration has launched a number of major energy research and development initiatives in the Department of Energy (DOE). These include the Energy Innovation Hubs, which bring together teams of the best researchers and engineers in the United States to solve major energy challenges. The Hubs are focused on the following topics: developing fuels that can be produced directly from sunlight, improving energy efficient building systems design, and using modeling and simulation for advanced nuclear reactor operations. Also, in FY 2012, Congress funded the President's request to launch new Hubs on electrochemical energy storage for transportation and the electric grid, and on critical materials. The 2013 Budget also proposes the Electric Systems Hub to explore the seams between transmission and distribution systems. Together, these six Hubs will shorten the path from basic discovery to laboratory innovation to technological development and help lead the way toward American competitiveness in these targeted areas.

The cost of solar modules has come down 75 percent in the past four years, from about $4 per watt in 2008 to $1 today. We are well on our way to achieving our ambitious goal – that solar power costs the same or less than fossil fuels by the end of this decade.

In October 2011, the Obama Administration announced that it would accelerate the permitting review of seven proposed electric transmissions lines through a Rapid Response Team for Transmission. These infrastructure projects, when built, will increase grid capacity, facilitating better integration of renewable energy sources, reducing congestion, and helping to accommodate the growing number of electric vehicles on the road.

In 2009, DOE's Advanced Research Projects Agency-Energy (ARPA-E) was funded for the first time ever with $400 million as part of the Recovery Act. The new agency invests in in early-stage, potentially transformational technologies that have higher technical risk, making them unlikely to attract private investment at their current stage of development. In total, ARPA-E has supported more than 200 individual projects. Projects include work to develop improved energy storage devices for the electric grid, efficient power-conversion technology, and efficiency for buildings. In addition, DOE's Energy Efficiency and Renewable Energy (EERE) program invests in potentially game-changing technologies for electricity generation, storage, and transmission.

6. Assuming there continue to be public investments in emerging energy generation technologies, can anyone reliably predict what technological breakthroughs may occur in energy generation at a specific point in the future? Absent being able to specify these technological breakthroughs, as well as their precise effects on the relative efficiency of the particular electricity source, in your view, is it possible to make robust probabilistic statements about future energy prices twenty years in the future?

Economic forecasts are imperfect, and technological breakthroughs and their future growth in industries are unpredictable. For example, in the late 1980s there were no models that predicted the rapid growth of Internet-based information and computing services that now employ several million workers. Innovation in this sector – initially catalyzed and continuously supported by government investment – has made key contributions to our economy.

The Administration proposes a framework that supports innovation in clean energy and other sectors of the economy. The Administration believes that certain targeted fundamental investments and regulations are necessary to promote the social good. This is particularly true in the case of investments for research and development, where knowledge spillovers and other externalities could result in private sector underinvestment especially in the most basic of research.

The Administration proposes to strike a balance, as described in *A Strategy for American Innovation*, by investing in the building blocks of innovation, setting an open and competitive environment for businesses and individuals to experiment and grow, and catalyzing breakthroughs in national priorities, including energy. In this way, we will harness the ingenuity of the American people and ensure an expansion of new technologies that are solid, broad-based, and beneficial for the American people and the Nation's economy.

Questions for the Record
The Honorable Dana Rohrabacher

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m.

QUESTIONS FOR DR. HOLDREN:

1. The COTS cargo demonstration missions I'm told cost about 40 percent more than originally planned. Was this because NASA added extra milestones or the companies encountered unexpected challenges? Please verify if this 40 percent increase is indeed accurate and provide rationale for the cost growth.

   The original COTS Space Act Agreement (SAA), signed by NASA and SpaceX in August 2006, included a maximum investment by NASA of $278 million. The Orbital Sciences Corporation (OSC) SAA, signed in February 2008, included a maximum NASA investment of $170 million. The NASA Authorization Act of 2010 added $300 million to the commercial cargo line for "enabling the commercial space industry in support of NASA to develop reliable means of launching cargo and supplies to the ISS throughout the duration of the facility's operation. The Administrator may apply funds towards the reduction of risk to the timely start of these services, specifically—

   (1) Efforts to conduct a flight test;

   (2) Accelerate development; and

   (3) Develop the ground infrastructure needed for commercial cargo capability."

   NASA jointly developed and negotiated augmentation milestones with each COTS partner to improve the chance of mission success. Thus, NASA considers the extra funds to be applied for additional risk reduction as opposed to "cost growth".

   The SpaceX Space Act Agreement was modified for a total of $118 million, to include:

   LIDAR testing (6 degree of freedom)

   Integrated spacecraft system level thermal vacuum, electromagnetic interference, and acoustic testing

   Ground infrastructure enhancements (launch, test, and production sites)

   Enhanced cargo capabilities

   Early Cargo Delivery (CRS)

   Orbital Sciences SAA was modified for a total of $118 million, to include:

Additional Antares test flight

Processor in the loop simulators and enhanced software testing

PROX flight equivalent unit (Space comm. radio) test unit simulators

Early Cargo Delivery (CRS)

2. NASA plans to demonstrate a broad range of Cryogenic Propellant Storage and Transfer (CPST) technologies in 2016. I am told NASA will use as a minimum H2 and perhaps LOX/LH2. However, for Morpheus, Johnson Space Center is pursuing an alternative fuel – LOX/LCH4. Depending on boil-off requirements, active or passive cooling may be advantageous. Will NASA insist on a zero or low cryo boil-off? Should NASA be considering safer, environmentally friendly, "greener" propellants that can better support cryogenic storage in space and integrate with life support, fuel cell consumables, and ISRU systems for extended stay? Will the CPST be a future technology element that will be infused into NASA's SLS program and architecture?

One of the most important and most significant NASA Space Technology Program (STP) investments is the Cryogenic Propellant Storage and Transfer (CPST) project under the Technology Demonstration Mission (TDM) program. The goal of this high-priority effort is to demonstrate the key technologies needed to perform long-duration storage and transfer of cryogenic propellants in space. These are enabling technologies that are critical for the US to perform human exploration missions beyond Low Earth Orbit. CPST is targeting a demonstration involving LH2 and possibly LH2/LOX. The choice of LH2 versus Liquid Methane (LCH4) is driven by the architectural demands for long duration space flight – LH2 has far better specific impulse compared to LCH4 and as a result it is far more mass efficient to develop LH2/LOX systems compared to LCH4/LOX systems. The efficiency of the propulsion system becomes more important the more distant the destination. Zero boil-off capability is not a requirement for the CPST demonstration, although achieving it would further extend our mission duration capability.

The choice for fuel for Morpheus was largely based on the ability to provide low-cost testing and incremental testing. The future infusion for CPST will depend on the retirement of key risks within the technology demonstration mission to be flown in FY 2016. The Space Technology program is designing the demonstration for potential infusion within the in-space Cryogenic Propulsion Stage, but could also see infusion into space craft designed for long duration, deep space missions.

Questions for the Record
The Honorable Randy Neugebauer

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m.

QUESTIONS FOR DR. HOLDREN:

1. After an extensive three-year site selection process that included a thorough risk assessment, environmental impact assessment, and security assessment, Manhattan, Kansas was selected as the location for the National Bio-and Agro-Defense Facility (NBAF). The site selection process occurred from 2006-2009, yet, the path to complete the NBAF, and to meet the urgent need of the Nation to be on the frontline of livestock animal health research to defend against communicable diseases passed from animals to humans is still unclear. In the Administration's FY13 budget request, no funding was requested for the NBAF. Why hasn't the President prioritized funding the construction of the NBAF?

The 2013 Budget does not fund construction of the National Bio- and Agro-Defense Facility (NBAF); rather, DHS will conduct a comprehensive reassessment of the need for and cost of a new laboratory. As my colleague Tara O'Toole, Under Secretary for the Science and Technology Directorate at the Department of Homeland Security (DHS), has testified before the Congress, construction of the NBAF was originally expected to be fully offset by the proceeds from the sale of the Plum Island facility. She stated in testimony in March of this year:

> **"Since then, the financial landscape has changed significantly. Today, we face the overall funding constraints of the Budget Control Act of 2011 (P.L. 112-25), which are impacting both the Department and S&T's budgets. Additionally, due to the current fiscal climate, the sale of Plum Island is not likely to provide adequate funds in the foreseeable future requiring appropriated funds for construction, and estimated construction costs for NBAF have increased by more than 30% as a result of construction delays and additional safety-engineering requirements. At the same time, Congressional appropriations have not kept pace with the costs to build the facility expeditiously. Given these fiscal challenges while considering the evolving security threats to U.S. agriculture, we have asked the NAS to convene an expert committee, in conjunction with the interagency, to conduct a scientific assessment of the requirements for a large-animal foreign and emerging diseases research and diagnostic laboratory in the United States."**

The Administration expects to rely on the judgment of this expert committee, which recently completed its study, in formulating future plans for the NBAF and other animal health research capabilities.

Questions for the Record
The Honorable Steven M. Palazzo

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m.

QUESTIONS FOR DR. HOLDREN:

1. NASA initiated the Commercial Orbital Transportation Services program in 2006. Along with the commercial cargo transportation systems, that program included a development phase for a commercial crew demonstration known as Capability D – Crew Transportation Demonstrations or COTS-D. We waited three years longer than the original plan for SpaceX to demonstrate the ability to carry cargo to the ISS and it ended up costing the taxpayers about 40 percent more than the original price. The Administration's strategy for acquiring multiple commercial crew systems has, over the past several years, been inconsistent in terms of cost and rationale. Currently, it lacks a defined plan for vehicle certification or a clear path to transition to a final contract for crew transportation services to the ISS.

   a. When will NASA have a more definitive plan?

   Although not yet complete, the Commercial Orbital Transportation Services (COTS) program appears to have been a major success for the United States. For a fraction of the cost of a traditional government development program, the Nation will have developed a capability to affordably service the International Space Station (ISS) and in addition helped to build a stronger and more competitive space industry. NASA's plans for commercial crew have been evolving as the program has advanced. NASA is currently finalizing its plans for vehicle certification and a clear path to transition to a final contract for crew transportation services to the ISS.

   b. Now that there is an 'understanding' for 2.5 companies going forward, what is the actual cost for the program?

   The FY13 President's Budget reflects NASA's budget requirements for the program in FY 2013. NASA is currently in blackout related to the Commercial Crew integrated Capability (CCiCap) announcement. NASA plans to incorporate information from the CCiCap awards in order to refine the program budget estimates for future years, and an updated request will be made as part of the 2014 Budget process.

   c. The promise of a robust commercial market was one of the pitfalls of the EELV program. When it didn't materialize those rockets became very expensive, a cost that is still borne by taxpayers today. It seems NASA will be the only market for these companies. How can they survive with such a limited government market?

   The CCiCap announcement requested market-research information to address this

question. This information is being used to better understand total potential non-NASA markets and to assess partners' understanding of the marketplace robustness. As mentioned previously, NASA is currently in procurement blackout for CCiCap.

Questions for the Record
The Honorable Mo Brooks

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m.

QUESTIONS FOR DR. HOLDREN:

1. NSF's Innovation Corps or I-Corps works to "bring together technological, entrepreneurial, and business know-how to move research discoveries toward commercialization." I know you are aware that several of my colleagues and I are concerned that the federal government is taking on a larger role in "applied" research, which can lead to government choosing winners and losers with commercialization of products. Understanding that commercialization is the end goal of the I-Corps projects, doesn't this activity fall into the trap of picking winners and losers? In fact, based on the mission of NSF, to serve as "a primary source of funding for basic curiosity-driven academic research," how is the I-Corps program appropriate for this agency at all? What other agencies have similar programs, and how much is the total federal government investment in this type of activity?

   NSF's mission is indeed to support basic, curiosity-driven academic research, and NSF is recognized and respected worldwide for its support of fundamental research in science and engineering identified through its merit-review process. There is no question that NSF-supported research has led and continues to lead to advancements in science and technology that can directly benefit the world in which we live. The Administration believes that it is good stewardship of Federal resources to assist NSF-funded researchers in identifying the potential for developing their groundbreaking ideas into a product or process with societal benefit. Congress has agreed with this idea in the America COMPETES Reauthorization Act of 2010, which called on NSF to "carry out a program to award merit-reviewed, competitive grants to institutions of higher education to establish and to expand partnerships that promote innovation and increase the impact of research by developing tools and resources to connect new scientific discoveries to practical uses." (Public Law 111-358, Section 508). The NSF I-Corps program fulfills this goal by amplifying rather than supplanting NSF's basic research mission, and is consistent with other longstanding NSF programs to support the innovation ecosystem, including Engineering Research Centers, Industry-University Cooperative Research Centers, Partnerships for Innovation, Science and Technology Centers, Nanoscale Science and Engineering Centers, the Materials Research Science and Engineering Centers, Grant Opportunities for Academic Liaison with Industry, and the Small Business Innovation Research (SBIR) program. These programs amplify NSF's investments in fundamental science and engineering research by offering multiple pathways for moving discovery to innovation.

   NSF's merit-review process for selecting I-Corps projects does not involve the Federal government picking industrial 'winners and losers.' I-Corps proposals are reviewed by NSF program directors, who are PhD scientists and engineers, venture capitalists, and entrepreneurs, and who are selected competitively using the tried-and-tested NSF merit-review process for making awards.

As Dr. Tom Peterson, Assistant Director for the Engineering Directorate at NSF, testified before you recently, the I-Corps program targets a critical gap that occurs just before NSF-funded researchers have advanced their ideas sufficiently to be eligible for SBIR funding and is designed to address other gaps that are not met by NSF's other innovation ecosystem programs. Because NSF I-Corps fills a unique niche and because NSF itself is unique in supporting basic, curiosity-driven academic research across the entire range of science and engineering disciplines, it is difficult to identify agencies with similar programs. However, the Department of Commerce's Economic Development Administration (EDA) and National Institute of Standards and Technology (NIST), and the Department of Energy's (DOE) ARPA-E and Energy Efficiency and Renewable Energy (EERE) are among the Federal agencies with programs also designed to bridge the gap between discovery and innovation. And of course, the longstanding interagency SBIR and Small Business Technology Transfer (STTR) programs annually provide more than $2 billion to small businesses and their partners to support discovery-oriented research leading to commercialization.

2. Your office and the GAO have issued reports this year on the number of STEM programs in existence across the federal government. Both reports found over 200 federal STEM programs (252 from OSTP and 209 from GAO) totaling over $3 billion. Congress is awaiting a STEM Strategic Plan to address the effectiveness and need for these programs. Particularly with the recent departure of Dr. Carl Wieman as the OSTP lead on this issue, what is the status of this Strategic Plan? Your testimony notes that it will be released later this year, but do you have a specific timeframe? Also, while the reports did not find direct duplication, they did find overlap in much of these programs. Will this strategic plan address consolidation of some of these very closely aligned programs, in addition to providing an outline for a path to "increase coordination and collaboration among the 13 agencies" funding STEM programs?

   Particularly with the recent departure of Dr. Carl Wieman as the OSTP lead on this issue, what is the status of this Strategic Plan? **As required by the America COMPETES Reauthorization Act, a progress report on the Strategic Plan was released earlier this year along with the President's FY2013 Budget. Since that time, the interagency National Science and Technology Council Committee on STEM Education (CoSTEM) has been meeting regularly to complete the Strategic Plan. The CoSTEM has been working diligently to develop the full Strategic Plan, including a detailed implementation section. The Strategic Plan will include details on how the four Coordination Goals will be achieved, specific roles that each agency will take to support the four Priority Areas, and common metrics and milestones to track the implementation of the strategic plan.**

   Your testimony notes that it will be released later this year, but do you have a specific timeframe? **The CoSTEM is working to release the Strategic Plan as soon as possible. Given the level of detail that will be included in the Strategic Plan and the time and effort that it takes to come to agreement on these details, it is difficult to provide a precise estimate.**

   Will this strategic plan address consolidation of some of these very closely aligned programs, in addition to providing an outline for a path to "increase coordination and collaboration among the 13 agencies" funding STEM programs? **The Strategic Plan will provide guidance for ensuring efficient and effective use of Federal funds for STEM education programs. This will involve a review of program effectiveness, duplication, overlap, and fragmentation, as well as other**

relevant information. While consolidation of programs is one option being explored, the CoSTEM intends to consider these two strategies along with a range of other strategies (e.g., strategic alignment of program goals, joint solicitations, improved program design and execution, increased alignment with evidence-based practices, shared evaluation and grant making capacity, and memoranda of understanding).

The Administration has also launched a number of initiatives to reinforce the Strategic Plan and encourage greater coordination and collaboration among the 13 agencies including a STEM cross-agency priority goal (CAP) to increase the number of well-prepared graduates with STEM degrees by one-third over the next 10 years, resulting in an additional 1 million graduates with degrees in STEM subjects. The Administration has developed the STEM CAP goal to build on the CoSTEM process, and its implementation will be informed by the Strategic Plan. The Administration will ensure that federal STEM investments are administered in a coordinated, strategic manner through its execution of the STEM CAP goal which includes two-year targets, quarterly progress reports, and a goal leader and team.

The Department of Education (ED) and the National Science Foundation (NSF) are leading efforts to facilitate using and building evidence in STEM programs. ED and NSF have worked together to develop an evidence framework and set of standards that can be used to align STEM activities across the government and inform decisions on where to invest Federal resources to accelerate learning. ED operates the What Works Clearinghouse, a comprehensive collection of rigorous research on education interventions, which is a useful platform for disseminating evidence that other STEM agencies could model.

ED and NSF have also moved towards aligning programs with similar goals to improve coordination including ED and NSF's Math and Science Partnership programs to improve STEM teacher professional development. ED and NSF also proposed $60 million for a jointly-administered mathematics education initiative that will support early research, development, validation, and scale-up of effective practices, drawing upon the strengths of both agencies and forging stronger connections between NSF's network of research universities and ED's network of State and local K-12 school leaders.

Furthermore, the GAO and CoSTEM analyses of overlap both used the same definition of "overlap," and both found that more than 80 percent of programs overlapped with at least one other program. Under this definition for overlap, two programs that are quite different but share even one element in each of four categories (*i.e.*, primary objective, audience, field of focus, and products/activities) are counted as overlapping, and every instance of overlap involved programs that had at least some—and in some cases many—program characteristics that differed greatly. The CoSTEM report carried out an examination of the degree and nature of similarity between each pair of "overlapping" programs and confirmed that there was a wide range in the degree of overlap.

Questions for the Record
The Honorable Andy Harris

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m.

QUESTIONS FOR DR. HOLDREN:

1. I would like to follow up on an exchange we had at the hearing regarding comments you made on redistribution of consumption. This exchange is transcribed below:

   DR. HARRIS: "In 2007, at a Climate Change Conference in Bali, your response to an interview question asked about whether 'Americans need to reduce their living standards,' you said—and this is a quote and I need to know whether it is accurate—'there is going to have to be a degree of redistribution of how much we consume.' Is that an accurate quote of what you said in 2007?"

   DR. HOLDREN: "I do not remember, sir, exactly what I said in 2007 but it sounds to me that I would have been talking about distribution between clean energy technologies and dirty energy technologies and where we get our consumption, what the processes are more broadly by which we support our standard of living."

   The complete quote from the Bali Climate Change Conference (available in video form here: http://www.mrctv.org/public/checker.aspx?v=Gd8zSUSU6U) is as follows (emphasis added):

   Dr. HOLDREN: There has been a strain of what many people call "US exceptionalism" in the United States, the notion that the United States is so big, so important, so powerful, so technologically advanced that it can and should do what it wants. I think this strain is misguided.

   Q: Will American need to reduce their living standards? Is that politically viable, or will technology [unintelligible] do it?

   *Dr. HOLDREN: **I think ultimately that the rate of growth of material consumption is going to have to come down, and there's going to have to be a degree of redistribution of how much we consume, in terms of energy and material resources**, in order to leave room for people who are poor to become more prosperous.*

   This expanded quote clearly demonstrates you were not speaking only about redistributing "clean" and "dirty" energy technologies, but rather you were also advocating redistribution of "material resources" as well as deceleration in the "rate of growth of material consumption."

   a. Please explain why you advocated redistribution of consumption in terms of both energy and material resources.

      Please notice I did not say that Americans need to reduce their living standards, but only that the rate of growth of consumption of energy and material resources would ultimately need to come down. The proposition that this must ultimately occur is a

consequence of the physical finiteness of the planet we inhabit. Consumption of physical things cannot grow forever in a finite place. In the advanced economy of the United States, we have been reducing the amount of energy needed to support a real dollar of GDP for forty years, and the same is true of raw materials. The result is we use less energy and fewer raw materials than China to produce a much larger GDP.

b. As part of this view do you believe U.S. consumption of energy and material resources should be reduced "in order to leave room for people who are poor to become more prosperous?" If not, which countries' consumption levels were you referring to?

As the quote indicates, I was talking about energy and material resources, not about goods and services. As noted in the answer above, improvements in technology can deliver increases in goods and services—and other dimensions of quality of life—from smaller amounts of energy and material. But my formulation in the Bali quote was not entirely apt. The redistribution of shares of global use of energy and materials between advanced and developing countries —a declining share of global use in the advanced countries and an increasing share in the developing ones— is not something that requires advocacy; it's a trend that occurs naturally as advanced countries increasingly base their economies on technologies that deliver more benefit for less energy and material, while developing countries are moving through an energy- and materials-intensive economic phase associated with less-advanced technologies and extensive construction of basic infrastructure.

c. Concerns surrounding international efforts to redistribute resources are not merely hypothetical. At the Rio conference in June, Canada's environment minister was quoted as saying that numerous countries pushed to make the gathering "a pledging conference for weather transfer." Can you assure us that President Obama and his Administration reject the idea of transferring wealth from America to other countries?

The Obama Administration does not support or promote transferring wealth from America to other countries.

2. Until just recently, President Obama regularly referenced the energy subsidies pursued in Europe—particularly Germany and Spain—as a model that he believes the U.S. should follow. However, even before the current fiscal crisis, countries all across Europe—Germany, Spain, France, the Netherlands, and the U.K.—dramatically scaled back their support for expensive renewable energy such as wind and solar. Why is the European subsidy model failing? How have the setbacks over there informed the Administration's policy in this area? Is there any reason to believe that a similar subsidy model in the U.S. would be more economically sustainable and have different results?

The President has called on Congress to pass legislation that will extend the Production Tax Credit (PTC), which provides an important tax credit to utility-scale wind producers in the United States. Thanks in part to these tax credits and other Administration investments, the United States has nearly doubled renewable energy generation from wind and solar power since the President took office. Because the PTC is different in several ways from the European feed-in-tariff, we cannot provide a general assessment of the successes and limitations of the European approach. A particular observation we have made of the Spanish experience, however, is that rapid and unpredictable changes in government policy

tend to undermine investor confidence. Similar effects have occurred in the United States as a result of previous starts and stops of the PTC. A stable policy approach, on the other hand, strengthens investor confidence and encourages more efficient, long-term private investment decisions.

3. During consideration of loan guarantees for alternative energy companies, OMB was heavily involved in reviewing and making recommendations. I presume, given OSTP's significant policymaking role and expertise in technology analysis that your office also played a role in reviewing these companies. Is this correct?

   It is well documented that, during consideration of Solyndra's loan guarantee application, career employees at the Office of Management and Budget (OMB) raised serious concerns about Solyndra's financial health and the viability of its business model. Those concerns were obviously not heeded. Did OSTP identify these same or similar concerns?

   We now know that the list of similarly failed or failing taxpayer-funded companies in addition to Solyndra is long and growing (Beacon Power, SunPower, First Solar, Energy1, Abound Solar, A123 Systems, just to name a few). Did OSTP identify concerns related to the applications of these companies? In retrospect, why do you think so many bad investments were approved? Is government simply incapable of making smart decisions in this area?

   OSTP did not play a role in reviewing the loan-guarantee applications to DOE, and therefore we were not in a position to identify any concerns over specific applications.

   If concerns regarding loan guarantees were raised, why do you think they went unheeded? Solyndra's lobbying of the White House and DOE has been well-documented. Did politics play too much of a role?

   Because OSTP did not play a role in reviewing the loan-guarantee applications in question, I am not in a position to speculate about the review process.

Questions for the Record
The Honorable Chip Cravaack

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

The Office of Science and Technology Policy:
Examining Priorities and Effectiveness of the Nation's Science Policies

Wednesday, June 20, 2012
10:00 a.m.

QUESTIONS FOR DR. HOLDREN:

1. The Department of Transportation spends approximately $600 million per year on surface transportation research, development, and technology deployment programs across all of its modes. We are currently looking at reauthorizing these programs, but one of the complaints that I commonly hear is that these programs lack strong coordination and are not prioritized to focus on national transportation needs. I recognize that historically earmarking of these programs has contributed to a lack of focus, but even now, as we look to authorize without earmarks, it is difficult to be confident the Department has a clear vision and strong guidance on research and development. Why hasn't OSTP been more actively engaged in coordinating these activities? What role is OSTP playing in helping to shape DOT research programs to ensure that taxpayers are getting the strongest return on their investments?

   OSTP's focus on science and technology (S&T) coordination has long been on S&T activities that require multiple Federal agencies to collaborate effectively for success; OSTP is less involved in S&T activities that are exclusively or predominantly the domain of one Federal department, as surface transportation research is in the Department of Transportation (DOT). As I indicated in my testimony, the primary mechanism for OSTP to coordinate science and technology activities throughout the Executive Branch is the National Science and Technology Council (NSTC), which OSTP administers. Although OSTP has not been active in surface transportation, OSTP and NSTC have been active in DOT's aeronautics research programs which require close collaboration between NASA, the Department of Defense (DOD), and others for success in meeting national needs. OSTP convenes the NSTC Subcommittee on Aeronautics Science and Technology, which ensures that DOT's Federal Aviation Administration (FAA), DOD, NASA, and other Federal agencies have a clear, shared vision and strong coordination for aeronautics research and development efforts. In December 2011, OSTP submitted to Congress the *2011 Progress Assessment for the National Aeronautics Research and Development Plan,* the fifth in a series of NSTC reports intended to provide a national policy and planning foundation for Federal aeronautics research and development. OSTP and these agencies are also involved in ongoing interagency efforts to implement the Next Generation Air Transportation System (NextGen).

2. The federal government has been funding STEM education for decades. Just over the past five years alone, we have spent over $16 billion on the issue. Every year, a larger emphasis is placed on the subject, and every year, we hear how we are falling further behind, What do we, as a Nation, have to show for all of the time, effort, and American taxpayer dollars that have already been devoted to this issue? What kind of return are we getting on our investment? What metrics do you have in place to routinely and uniformly measure performance and success across the federal agencies? How can we be confident that we are putting this money in the right place and

on the right activities?

Student test scores largely present a picture of slow improvement in achievement according to information summarized and presented by NSF's Science and Engineering Indicators (2012). Scores on the National Assessment of Educational Progress (NAEP) mathematics test have increased among fourth, eighth, and twelfth graders. From 1990 to 2007, average mathematics scores increased by 27 points (out of a 500-point scale) for fourth graders. Scores then leveled off in 2009 across almost all demographic groups. At grade 8, average mathematics scores steadily gained 20 points from 1990 to 2009, with improvement for most demographic groups. Among 12th graders, average mathematics scores showed a gain from 2005 to 2009. These improvements in performance were shared by boys and girls and across racial, ethnic, and economic groups. While gaps in achievement narrowed for African-American students as compared to white students, score gaps among demographic groups remained substantial. Similar gains were also seen in the 2007 Trends in International Mathematics and Science Study (TIMSS) in mathematics but not in science. However, on the 2006 Program for International Student Assessment (PISA), U.S. 15-year-olds scored below most selected nations and the U.S. dropped below its rank in 2000 in both mathematics and science.

National and state education policies focus on improving learning by U.S. students. National policy goals include increasing student achievement over all, reducing disparities in performance among key subgroups of students, moving the international ranking of U.S. students from the middle to the top over the next decade, and regaining U.S. leadership in STEM education. Many Federal agencies are making investments to move U.S. students toward these goals. As one example, NSF's investments in STEM education fields reflect strong support for the R&D elements of recent reform efforts, including studying common core state standards in mathematics, strengthening curricula, promoting advanced course taking, enhancing teacher quality, and expanding technology in education to address student performance. As discussed in Science and Engineering Indicators (2012), progress varies among regions and school districts, and differs between middle and high school. While the percentage of public middle and high school science and mathematics teachers with advanced degrees and full certification has increased since 2003, science teachers in high-poverty schools were less likely to have advanced degrees than science teachers in low-poverty schools. In-field teaching in science and mathematics was less prevalent at lower than at higher grade levels, but most high school teachers of mathematics and science taught in field. Based on 2007 data (and reported again in 2012), 88 percent of high school teachers in mathematics, and 93 percent of high school teachers in biology/life sciences taught in field.

Patterns are clearly nuanced and progress has been slower than hoped; however, NSF believes that its emphasis on research and development in STEM education will help to address concerns about whether investments are going to the right activities. For example, programs that have traditionally focused almost exclusively on capacity building, such as HBCU-UP and other programs in the Division for Human Resource Development (HRD), are adding a strand on Broadening Participation Research, which will provide support to research projects that seek to create and study new theory-driven models and innovations related to the participation and success of diverse groups in STEM undergraduate education. Thus, NSF funding will help to develop the knowledge base in this area while continuing to directly support institutions as they improve their quality of education.

Appendix 2

Additional Material for the Record

PREPUBLICATION COPY—SUBJECT TO FURTHER EDITORIAL CORRECTION

Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories

Committee to Review the Quality of the Management and of the Science and Engineering Research at the Department of Energy's National Security Laboratories – Phase I

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Wednesday, February 15, 2012
11:00 a.m. EDT

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Summary

The three National Security Laboratories-- Los Alamos National Laboratory, Sandia National Laboratories, and Lawrence Livermore National Laboratory-- are managed by private sector entities under contract to the National Nuclear Security Administration (NNSA). The FY2010 Defense Authorization Act mandated that NNSA task the National Research Council (NRC) to study the quality and management of Science and Engineering (S&E) at these Laboratories. Specifically, NRC was tasked to address for each Laboratory:

(1) The quality of the scientific research being conducted at the Laboratory, including research with respect to weapons science, nonproliferation, energy, and basic science.
(2) The quality of the engineering being conducted at the Laboratory.
(3) The criteria used to assess the quality of scientific research and engineering being conducted at the Laboratory.
(4) The relationship between the quality of the science and engineering at the Laboratory and the contract for managing and operating the Laboratory.
(5) The management of work conducted by the Laboratory for entities other than the Department of Energy, including academic institutions and other Federal agencies, and interactions between the Laboratory and such entities.

This study is being conducted in two phases. This report covers the first phase, which addresses tasks (4) and (5) and partially addresses task (3): roughly speaking, how management at all levels affects the quality of the science and engineering (S&E) at the three Laboratories. The study's second phase will evaluate the actual quality of S&E in key subject areas.

"Quality of S&E" measures the expertise and accomplishments in those areas of science and engineering that are necessary to accomplish the Laboratories' missions. "Quality of the management of S&E" measures management's capability to build, maintain and nurture S&E expertise for current and future mission needs. The S&E performed by any Laboratory can only be as good as the people employed. Thus, ensuring that high-quality people are attracted to the NNSA National Security Laboratories, and that they are retained, is a necessary condition for the Laboratories to carry out high-quality S&E. Assuming that foundation is available, high-quality S&E then requires good facilities and adequate resources, and operating processes that do not impede the ability of those scientists and engineers to perform at their highest levels. Management controls these conditions, and this report evaluates the quality of the Laboratories' management, at all levels, by its success in providing these prerequisites for high-quality S&E. Management includes government (primarily NNSA and its three site offices), the management and operations (M&O) contractors, and on-site Laboratory management.

Because of this high-level view of management's role with respect to the quality of S&E, the study committee saw no distinction between management of the Laboratories' work for NNSA (roughly, Task 4) and their work for other entities (Task 5). Therefore, the discussion and recommendations in this report generally apply to the Laboratories' S&E work across the board.

Each of these Laboratories is a Federally Funded Research and Development Center (FFRDC) operated for NNSA under a Government-Owned/Contractor-Operated (GOCO) relationship. This contracting mechanism allows the government access to the capabilities and knowledge of industry and universities to manage these technically complex institutions. Contracting relationships for some FFRDCs—in particular LLNL and LANL—have endured for many decades. In 2004, Congress mandated that the long-standing contracts with the University of California to manage Lawrence Livermore and Los Alamos national Laboratories (LLNL and LANL) be re-competed.[2] As a result, these two M&O contracts were awarded to two independent LLCs that both include Bechtel Corporation and the University of California.[3] Subsequently, a number of current and former employees of these Laboratories have expressed concerns about deterioration of morale at the Laboratories along with ongoing or potential declines in the quality of science and engineering. Many of those employees attributed those inferred trends to the new M&O contracts and contractors.

To carry out this study, the study committee met with Congressional staffers, senior leadership of NNSA and the Department of Energy, staff from the NNSA site offices that serve as a vital link between NNSA and day-to-day Laboratory management, and a wide variety of former and current employees of the three Laboratories. It held site visits at each of the Laboratories, organized around panel discussions with a large number of employees at different levels, from bench scientists to senior management. The study committee controlled the agendas for all of its meetings and had final say on the list of speakers. At LANL and LLNL, the study committee also held well-advertised public sessions at which anyone was invited to speak and management was voluntarily absent. The study committee also examined past reports on the Laboratories and the language of the current contracts. Details of the study processes are included in Chapter 1 of this report.

While the new contracts at LANL and LLNL clearly produced a noticeable level of staff frustration, staff members with whom the study committee interacted continued to show a strong commitment to their work. Those who testified to the study committee about morale problems spoke primarily of the situation as it existed at the time of the contract transitions, or of the subsequent layoffs at LLNL. When the study committee examined the M&O contracts, it found very little that prescribes the management of S&E. Many of the bureaucratic frustrations raised at all levels appear to be either within the power of the Laboratories to address or driven by governance strategies above the Laboratory level: they are not traceable to the M&O contractor or the contracts themselves. It is indeed true that all three Labs have been under cost and funding pressure. In the case of LANL and LLNL that pressure is connected with the contract change; the costs of their re-competed contracts are significantly greater than the previous contracting arrangements. But this is due to the combined effect of increased contractor fees, pension obligations, and, in the case of LANL, a need to now pay New Mexico state taxes. Accounts that attribute the increased cost simply to award fees are not accurate. Some employees and stakeholders have been concerned that

[2]U. S. Congress, H. Rpt. 108-292, Division C-Energy and Water Appropriations Act, 2005, Sec. 301, p.151, Nov. 2004. The new M&O contractor for LANL took over in 2006, and the new contractor for LLNL began work in 2007.

[3]The parent organizations of Los Alamos National Security (LANS) are The University of California, Bechtel, Babcock and Wilcox, and URS. For Lawrence Livermore National Security (LLNS) the parent organizations consist of the same four plus Battelle.

M&O contractors pursuing a fee might not act in the public interest, and this is an important issue. Therefore, the study committee discussed incentives with the three Laboratory directors and was convinced that their primary objective remains to manage the Laboratories in the public interest.

An evolution of the Laboratory missions to "National Security Laboratories" is well underway. The absence of nuclear testing means that experimental validation of much of the S&E performed by the Laboratories is not possible, and thereby lessening the intellectual attractiveness of the work for at least some prospective employees. The expansion of the Laboratories' mission into new non-nuclear areas offers the prospect of increasing the Laboratories' appeal to top-quality scientists and engineers while also serving important national security missions. Thus, the quality of S&E, being preconditioned on attracting high-quality people, depends in the long run on successfully making this transition to National Security Laboratories. It is for this reason that the study committee was pleased to see that, a governance charter has been established among the Departments of Energy, Homeland Security, and Defense, plus the Office of the Director of National Intelligence [4] Many of the challenges facing these agencies are synergistic with the capabilities of these NNSA Laboratories, and they can, and do, benefit from the large investments that NNSA and its predecessors have made in S&E capabilities. In a time of constrained budgets, broadening the mandate to a national security mission helps preserve S&E expertise by providing opportunities to work on problems posed by partner agencies. However, while such Work for Others (WFO) is very important for the future of S&E at the Laboratories, all three of the Laboratory directors were very clear that maintenance of the nuclear weapons stockpile remains the core mission of the Labs.

Recommendation 3-1[5]:

The study committee recommends that Congress recognize that maintenance of the stockpile remains the core mission of the Labs, and in that context consider endorsing and supporting in some way the evolution of the NNSA Laboratories to National Security Laboratories as described in the July 2010 four-agency Governance Charter for an Interagency Council on the Strategic Capability of DOE National Laboratories.

A crucial part of the Laboratories' ability to conduct their missions is derived from Laboratory Directed Research and Development (LDRD), the primary source for internally directed R&D funding. Among its other benefits, LDRD provides a major resource for supporting and training staff at each Laboratory.

[4] See Appendix 1 "Governance Charter for an Interagency Council on the Strategic Capability of DOE National Laboratories as National Security Assets."
[5] The first number refers to the chapter of the report in which the recommendation appears.

Recommendation 3-2:

The study committee recommends that Congress and NNSA maintain strong support of the LDRD program as it is an essential component of enabling the long-term viability of the Laboratories.

Historically, Laboratories had another source of discretionary research spending. The weapons program (at each Laboratory) had the flexibility to use part of its budget to fund a robust research program, in support of the core weapons mission. Currently, the weapons program budget is subdivided into so many categories with so many restrictions that this important flexibility is effectively lost. This loss in funding flexibility has significantly reduced the amount of core program research being performed at the Laboratories. This lessens the appeal of the Laboratories when recruiting scientists and engineers.

Recommendation 3-3:

The study committee recommends that Congress reduce the number of restrictive budget reporting categories in the Nuclear Weapons Program and permit the use of such funds to support a robust core weapons research program and further develop necessary S&E capability.

In the view of this committee, the relationship between NNSA and its National Security Laboratories is broken to an extent that very seriously affects the Labs' capability to manage for quality S&E. There has been a breakdown of trust and an erosion of the partnering between the Laboratories and NNSA to solve complex S&E problems; there is conflict and confusion over management roles and responsibilities of organizations and individuals. For example, the study committee heard reports of mid-level issues being elevated to the Laboratory director level because there was no clarity about how to resolve disputes between a Laboratory and an NNSA Site Office. Another example was a recent instance in which NNSA HQ tried to overrule a Laboratory's best scientific judgment about how to carry out a scientific task. Subsequently, language appeared in a Congressional report opposing that NNSA order. A better mechanism could be established for resolving technical disputes, without elevating them to top NNSA management and congressional levels. A technical advisory committee, established at the NNSA level, would be a helpful mechanism for filling this gap in S&E management. More generally, such an advisory committee could monitor progress on other aspects of roles and responsibilities, as described next.

Erosion of trust on both sides of the relationship shapes the oversight and operation of the Laboratories, resulting in excessive bureaucracy governing Laboratory activities at a deep level of detail, including the conduct of S&E. The study committee observed widespread perception among Laboratory S&E staff and some managers that NNSA oversight activities were inconsistent with statements by NNSA that oversight is accomplished without being intrusive; i.e., "eyes on, hands off". The study committee was repeatedly told that oversight officials frequently blur the line between oversight and evaluation and insert themselves in an operational role. This problem was reported to occur in many aspects of Laboratory activities.

This erosion of the trust relationship is prominent with respect to LANL, where past failures in safety, security, and business practices attracted much national attention and public criticism. But it has also spilled over to LLNL and SNL. The loss of trust in the ability of the Laboratories to maintain operational goals such as safety, security, environmental responsibility and fiscal integrity has produced detailed scrutiny by NNSA HQ and site offices and increased aversion to risk. A major byproduct of this has been to create a bias against experimental work, because of the onerous processes sometimes required before running an experiment. The bias is problematic because experimental science is at the very heart of the scientific method.

The FFRDC relationship is based on a partnership between the Federal government and a Laboratory in which the government decides what problems need to be addressed and the contractor determines how best to address those problems. There is a perception among S&E staff and managers at the three Laboratories that NNSA has moved from partnering with the Laboratories to solve scientific and engineering problems, to assigning tasks and specific S&E solutions with detailed implementation instructions. This approach precludes taking full advantage of the intellectual and management skills that taxpayer dollars have purchased. The study committee found similar issues in transactional oversight of safety, business, security and operations. Science and engineering quality is at risk when Laboratory scientists and engineers are not encouraged to bring forth their creative ideas in partnership with NNSA to solve problems vital to our national security.

Recommendation 4-1:

The study committee recommends that NNSA and each of the Laboratories commit to the goal of rebalancing the managerial and governance relationship to build in a higher level of trust in program execution and Laboratory operations in general.

Recommendation 4-2:

The study committee recommends that NNSA and the Laboratories agree on a set of principles that clearly lay out the boundaries and roles of each management structure, and also that program managers at headquarters, the Site Offices, and in the Laboratories be directed to abide by these principles.

For example, the Site Manager and the Director and/or Deputy Director of each Laboratory could establish, in consultation with other Lab staff, a process to identify and agree on eliminating certain oversight procedures that are not necessary or related to the overall goals of the Laboratory. Similarly, some mechanism could be established to filter program taskings at both the headquarters level and at the Laboratory senior management level to assure that each tasking is necessary and consistent with the agreed management principles.

Recommendation 4-3:

The study committee recommends that the goal of rebalancing the relationship and

the set of principles laying out the boundaries and roles of each management structure be memorialized in memoranda of understanding between NNSA and its Laboratories. NNSA should assess performance against these understandings on an annual basis over a five-year period and report these assessments to Congress.[6]

A key to ongoing Laboratory success has been a strong focus on the long term and on maintaining deep technical capability. Under the new management structure of the Laboratories, industrial and other private sector partners can help assure that this long-term focus is maintained.

Recommendation 5-1:

The study committee recommends that the NNSA, Congress, and top management of the Laboratories recognize that safety and security systems at the Laboratories have been strengthened to the point where they no longer need special attention. NNSA and Laboratory management should explore ways by which the administrative, safety, and security costs can be reduced, so that they not impose an excessive burden on essential S&E activities.

Recommendation 5-2:

The study committee recommends that NNSA reduce reporting and administrative burdens on the Lab directors, and purposely free directors to establish strategic science and engineering direction at the Laboratories.

Among other benefits, this may encourage Lab directors to serve longer terms with the organization.

[6] The committee observes that it is important to design this approach to be self-correcting and to avoid problems such as: (1) adding to a check-list approach to management; (2) enforcing measures that annual assessment shows to be unworkable; and (3) requiring Congressional intervention when not needed.

Interim Report—Status of the Study

"An Assessment of the Prospects for Inertial Fusion Energy"

Committee on the Prospects for Inertial Confinement Fusion Energy Systems
Board on Physics and Astronomy
Board on Energy and Environmental Systems
Division on Engineering and Physical Sciences
NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

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1 Executive Summary

In this interim report, the Committee on the Prospects for Inertial Confinement Fusion Energy Systems reached the following preliminary conclusions and recommendations.

Conclusion 1: The scientific and technological progress in inertial confinement fusion has been substantial during the past decade, particularly in areas pertaining to the achievement and understanding of high-energy-density conditions in the compressed fuel, in numerical simulations of inertial confinement fusion processes, and in exploring several of the critical technologies required for inertial fusion energy applications (e.g., high-repetition-rate lasers and heavy-ion-beam systems, pulsed-power systems, and cryogenic target fabrication techniques).

Despite these advances, however, many of the technologies needed for an integrated inertial fusion energy system are still at an early stage of technological maturity. For all approaches to inertial fusion energy examined by the committee (diode-pumped lasers, krypton fluoride lasers, heavy-ion accelerators, pulsed power; indirect drive and direct drive), there remain critical scientific and engineering challenges associated with establishing the technical basis for an inertial fusion energy demonstration plant.

Conclusion 2: It would be premature at the present time to choose a particular driver approach as the preferred option for an inertial fusion energy demonstration plant.

The committee recognizes, of course, that such a down-selection among options will eventually have to be made. In its final report, the committee will provide examples of key experimental results that will be needed to inform the decision points regarding which driver-target combinations are most likely to succeed.

The U.S. Department of Energy's (DOE's) National Nuclear Security Administration (NNSA) supports a major national effort in inertial confinement fusion at the National Ignition Facility (NIF) that is focused primarily on addressing technical issues related to stewardship of the nation's nuclear weapons stockpile and national security. An intense national campaign is underway to achieve ignition conditions on the NIF, and there has been considerable initial technical progress toward this major goal, although progress has been slower than originally anticipated.[1]

The current NIF laser, targets, shot repetition rate, production methods, and materials are not specifically designed to be suitable for inertial fusion energy (IFE) applications.

[1] Steven Koonin, DOE Under Secretary for Science, "Fourth Review of the National Ignition Campaign," November 8, 2011.

Nevertheless, many experiments that could be done using the NIF would be valuable for IFE even if the achievement of ignition is delayed—particularly those that provide experimental validation of predictive capabilities.

The above discussion led the committee to make the following recommendation.

Recommendation: Planning should begin for making effective use of the National Ignition Facility as one of the major program elements in an assessment of the feasibility of inertial fusion energy.

2 Background

The National Research Council, National Academy of Sciences, and National Academy of Engineering's America's Energy Future study reviewed current patterns of energy production and consumption in the United States[2] and the growing concerns with energy security and the environmental impacts of current fuels. For example, the study found that the United States depends on fossil fuels (coal, natural gas, and—to a minor extent—oil) for 69 percent of its electricity generation, with nuclear fission accounting for an additional 21 percent. Although the fossil and nuclear fuels used are largely domestic in origin, there are many reasons why using them for electricity generation is less than ideal. Burning fossil fuels releases greenhouse gases such as carbon dioxide that appear to be altering the global climate, while concerns about nuclear fission remain, such as the possibility of accidents, the long-term storage of high-level nuclear waste, and the security and proliferation risks associated with widely distributed and highly radioactive nuclear materials.

Not considered in the America's Energy Future analysis were the prospects for electricity generation from nuclear fusion, which offers the potential for a carbon-free source of energy with an abundant source of fuel and greatly reduced concerns about long-term storage and disposal of radioactive waste compared with existing nuclear fission energy systems.

There are two main approaches to nuclear fusion: inertial confinement fusion (ICF) and magnetic confinement fusion. Historically, the great majority of U.S. Department of Energy (DOE) funding for energy-related fusion research and development (R&D) has supported activities in magnetic confinement fusion, and consequently the technology for magnetic fusion energy is further advanced, with an internationally funded facility now under development to demonstrate several aspects of technical feasibility.[3] However, the DOE's National Nuclear Security Administration (NNSA) supports a major national effort in inertial confinement fusion focused primarily on addressing technical issues related to stewardship of the nation's nuclear weapons stockpile and national security.

The final report of the present study will evaluate the current status and future prospects for one of the two major approaches to nuclear fusion energy—inertial confinement

[2] National Academy of Sciences, National Academy of Engineering, and National Research Council, *America's Energy Future: Technology and Transformation*, The National Academies Press, Washington, D.C. (2009).
[3] ITER, formerly known as the International Thermonuclear Experimental Reactor, is a magnetic confinement fusion experiment facility currently under construction in southern France. More information can be found at URL http://www.iter.org/, accessed June 30, 2011.

fusion—to contribute to the U.S. electricity generation mix. This interim report has a much more limited scope and is intended to provide the sponsor with a snapshot of the direction of the committee's thinking after its first four meetings.

The present NRC study focuses on inertial fusion energy (IFE), which is based on the inertial confinement fusion approach. A primer on the principles of inertial fusion energy systems is provided in Appendix A. During the past decade, several prominent studies have reported favorably on the prospects for inertial fusion energy (e.g., see Fusion Energy Sciences Advisory Committee - 2004 panel report on Review of Inertial Fusion Energy Program; Fusion Energy Sciences Advisory Committee - 2003 panel report on Plan for Development of Fusion Energy; 2002 Snowmass meeting on fusion energy; the full bibliographic references for these reports are in Appendix E).

The NNSA's recently commissioned National Ignition Facility (NIF) has the stated goal of achieving ignition[4] with an inertial confinement fusion target by the end of FY2012.[5]

Previous funding sources for inertial fusion energy R&D have been diverse and have included Laboratory Directed Research and Development (LDRD) funds at NNSA laboratories (e.g., Laser Inertial Fusion Energy (LIFE) and pulsed-power approaches), direct funding through the Office of Fusion Energy Sciences (e.g., heavy-ion fusion, fast ignition, magnetized target fusion), and congressionally mandated funding (e.g., the High-Average-Power Laser (HAPL) programs for krypton fluoride (KrF) and diode-pumped lasers).[6]

Thus, while there have been diverse past and ongoing research efforts sponsored by various agencies and funding mechanisms that are relevant to IFE, at the present time there is no nationally coordinated research and development program in the United States aimed at the development of inertial fusion energy that incorporates the spectrum of driver approaches (diode-pumped lasers, heavy ions, krypton fluoride lasers, pulsed power, or other concepts), both indirect-drive and direct-drive target designs (see Appendix G for definitions), or any of the unique technologies needed to extract energy from any of the variety of driver and target options.

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[4] John D. Lindl, Peter Amendt, Richard L. Berger, S. Gail Glendinning, Siegfried H. Glenzer, Steven W. Haan, Robert L. Kauffman, Otto L. Landen, and Laurence J. Suter, "The Physics Basis for Ignition Using Indirect-Drive Targets on the National Ignition Facility," *Physics of Plasmas*, Vol. 11, Issue 2, 339 (2004); doi:10.1063/1.1578638 (153 pages).

[5] Steven Koonin, DOE Under Secretary for Science, "Fourth Review of the National Ignition Campaign," November 8, 2011.

[6] Research in these various approaches is conducted across multiple labs and universities, although the driver approaches are usually identified with the following institutions: diode-pumped solid-state lasers (Lawrence Livermore National Laboratory and the Laboratory for Laser Energetics at the University of Rochester); pulsed power (Sandia National Laboratories); heavy-ion fusion (Lawrence Berkeley National Laboratory); magnetized target fusion (Los Alamos National Laboratory); and krypton fluoride lasers (Naval Research Laboratory).

3 The Committee's Information-Gathering Process

The analysis in this report is based on:

- Review of many past studies on inertial fusion energy systems;[7]
- Briefings received on the ongoing research related to inertial fusion energy systems in the United States and around the world;
- Site visits conducted at major inertial confinement fusion facilities in the United States; and
- Expertise of the committee's membership in key areas relating to inertial confinement fusion.

Meeting agendas and site visits conducted by the committee are provided in Appendix D. A bibliography of past inertial confinement fusion studies consulted by the committee is given in Appendix E.

4 Recent Scientific and Technological Advances in Inertial Confinement Fusion

Inertial fusion science and driver/target technologies are in a highly productive period of exploration driven by innovative ideas, precision diagnostics and engineering systems, ever-improving experimental techniques, and advanced numerical simulations. Detailed comparison of experimental results with simulations has proven to be very valuable in improving the understanding of high-energy-density physics, damage to materials under fusion conditions, the relative merits of various drivers, and many other issues relevant to IFE.

In addition, the committee received technical input describing advances on many fronts, including indirect-drive and direct-drive fusion schemes,[8] heavy-ion-beam focusing[9] and pulse compression,[10] and advances in pulsed-power fusion.[11] The committee also

[7] See Appendix E.
[8] J.D. Sethian et al., "The Science and Technologies for Fusion Energy with Lasers and Direct-Drive Targets", *IEEE Transactions on Plasma Science*, Vol. 38, 690-703 (2010).
[9] P.K. Roy et al., "Results on Intense Beam Focusing and Neutralization from the Neutralized Beam Experiment," *Physics of Plasmas*, Vol. 11, 2890 (2004).
[10] P.K. Roy et al., "Drift Compression of an Intense Neutralized Ion Beam," *Physics Review Letters*, Vol. 95, 234801 (2005).
[11] S.A. Slutz et al., *Physics of Plasmas*, Vol. 17, 056303 (2010); and Michael E. Cuneo et al., "Pulsed Power IFE: Background, Phased R&D, and Roadmap," presentation to NRC Committee on the Prospects for Inertial Confinement Fusion Energy Systems, April 1, 2011, Albuquerque, New Mexico.

received input concerning exploratory concepts such as shock ignition,[12] fast ignition,[13] and magnetized target fusion,[14,15] which, if their potential is realized, may also have an impact on inertial fusion energy in the longer term.

An intense national campaign is underway to achieve ignition conditions on the NIF, and there has been considerable initial technical progress toward this major goal.[16] While technical progress has been slower than originally anticipated,[17] the eventual achievement of ignition on the NIF, and particularly the achievement of moderate single-shot gain (10–20, say), would provide significant validation of key scientific underpinnings required for developing inertial fusion as a practical energy source.

The committee noted that there is a substantial university community engaged in inertial confinement fusion experiments at the national laboratories[18,19] There is also a strong university community active in high-energy-density science research, both at local facilities and at user facilities, which make important contributions to inertial confinement fusion concepts and techniques. Some of the major contributions that universities make in addition to improved understanding of the physics of extreme states of matter at the fundamental level, are the training of graduate students and postdoctoral associates who provide the source of scientific and engineering manpower, as well as the development and testing of new ideas and long-range technologies that are sometimes difficult to carry out in a mission-focused program.

In parallel with the significant scientific advances, there have been impressive R&D efforts to develop a wide range of driver technologies.[20] However, very little effort has been spent on developing the technology of the reactor chambers or on addressing materials problems peculiar to inertial fusion. Finally, international R&D programs in

[12] R. Betti, C.D. Zhou, K.S. Anderson, L.J. Perkins, W. Theobald, and A.A. Solodov, "Shock Ignition of Thermonuclear Fuel with High Areal Density," *Physics Review Letters*, Vol. 98, 155001 (2007).
[13] M.H. Key, "Status and Prospects for the Fast Inertial Fusion Concept," *Phys. Plasmas*, Vol. 14, 055502 (2007).
[14] F.J. Marshall et al., *Physical Review Letters*, Vol. 102, 185004 (2009); and T.P. Intrator et al., *Journal of Fusion Energy*, Vol. 28, 165-169 (2009).
[15] P.Y. Chang, G. Fiksel, M. Hohenberger, J.P. Knauer, R. Betti, F.J. Marshall, D.D. Meyerhofer, F.H. Séguin, and R.D. Petrasso, "Fusion Yield Enhancement in Magnetized Laser-Driven Implosions," *Physics Review Letters*, Vol. 107, 035006 (2011).
[16] E. Moses, "Ignition on the National Ignition Facility: A Path Towards Inertial Fusion Energy," *Nuclear Fusion*, Vol. 49, 104022 (September 10, 2009).
[17] Steven Koonin, DOE Under Secretary for Science, "Fourth Review of the National Ignition Campaign," November 8, 2011.
[18] E. Moses and W. Meier, "The National Ignition Facility and the Golden Age of High Energy Density Science," *IEEE Transactions on Plasma Science*, Vol. 36, 802-808 (2008).
[19] J.D. Sethian et al., "The Science and Technologies for Fusion Energy with Lasers and Direct-Drive Targets," *IEEE Transactions on Plasma Science*, Vol. 38, 690-703 (2010).
[20] Ibid.

inertial fusion energy are continuing to expand and receive increased emphasis, particularly in Europe,[21] Japan,[22] Russia,[23] and China.[24]

In summary, the committee has consulted with most of the key individuals and laboratories at the forefront of IFE-related research and is impressed with the quality of the science and technology and how much progress has been made in the past decade. It also recognizes how challenging and complex the unresolved issues are and how much remains to be accomplished and understood if IFE is to become a practical energy source. Each potential driver and target combination has advantages and disadvantages, technologies are evolving rapidly, and scientific challenges remain. If the nation intends to establish inertial fusion energy as part of its energy R&D portfolio, it is clear that both science and technology components must be addressed in an integrated and coordinated effort.

5 Important Factors from a Power Plant Perspective

For inertial confinement fusion to become a practical energy source, several factors are important from a power plant perspective. These include:

- Cost competitiveness of the capital, fuel, operation, and maintenance costs;
- The ability to operate the plant continuously and with high availability in the extreme radiation environment of 14 MeV neutrons and target debris;
- The difficulty and frequency of the required periodic inspections and maintenance operations;
- The ease of operation; and
- Low environmental, health, and safety consequences (including management of radioactive waste), both in normal operation and under accident conditions.

[21] John Collier, "Recent Activities and Plans in the EU and UK on Inertial Fusion Energy," presented to the National Research Council Committee on Prospects for Inertial Confinement Fusion Energy Systems, June 15, 2011; and Boris Sharkov, "HIF E: Activities in Europe and in Russia" and "Extreme State of Matter Physics at FAIR," presented to the National Research Council Committee on Prospects for Inertial Confinement Fusion Energy Systems, October 31, 2011.

[22] Hiroshi Azechi, "Inertial Fusion Energy: Activities and Plans in Japan," presented to the National Research Council Committee on Prospects for Inertial Confinement Fusion Energy Systems, June 15, 2011.

[23] Boris Sharkov, "Heavy Ion Fusion Energy: Activities in Europe and in Russia" and "Extreme State of Matter Physics at FAIR," presented to the National Research Council Committee on Prospects for Inertial Confinement Fusion Energy Systems, October 31, 2011.

[24] Jie Zhang and Xiantu He, "Inertial Fusion Energy: Activities and Plans in China," presented to the National Research Council Committee on Prospects for Inertial Confinement Fusion Energy Systems, June 16, 2011.

The committee received presentations and documentation that summarized the reactor design concepts for several driver approaches, including high-average-power diode-pumped lasers and KrF lasers, heavy-ion fusion, and pulsed-power fusion. The current designs of IFE plants have used best-guess cost estimates for components and targets.[25] The most recent detailed study of an IFE system is the Laser Inertial Fusion Energy (LIFE) study, which examined one option (based on indirect-drive targets, a diode-pumped solid-state laser, and a gas-filled, solid first wall).[26] This study, as well as previous power system studies, have provided much useful insight into the issues and challenges facing IFE systems. While considerable progress has been made in the LIFE design and in other approaches, the committee concluded, based on the presentations and materials provided, that it would be premature to down-select among driver options at the present time. The committee further concluded that, to the extent possible, it is critical to continue the development of several promising technologies and driver options to ensure that the most suitable technologies are available for commercial manufacturers to design, license, and build fusion power plants that will operate reliably, safely, and economically. In addition, the committee believes that it would be prudent to direct a portion of the inertial fusion energy R&D portfolio at a time frame longer than 20 or 30 years, in order to examine promising but less explored advanced concepts and technologies.

Finally, it will be important for a number of reasons to achieve a high target gain (~50–200) for a practical inertial fusion power plant. A fraction of the gross power produced by the plant must be used to drive the driver. This fraction is inversely proportional to the product of target gain and driver efficiency. Therefore, higher target gain leads to higher net energy production and lower cost of power. Target types that have higher overall gain can operate at lower driver energy and still produce adequate energy output.[27] This factor is particularly important because a major challenge for achieving competitive fusion power is the capital cost of the facility. Moreover, higher

[25] Examples include the following: Thomas M. Anklam, Mike Dunne, Wayne R. Meier, Sarah Powers, and Aaron J. Simon, "LIFE: The Case for Early Commercialization of Fusion Energy," *Fusion Science and Technology*, Vol. 60, 66 (2011); W.R. Meier, "Systems Modeling for a Laser-driven IFE Power Plant Using Direct Conversion," *J. Phys.: Conf. Ser.*, Vol. 112, 032036 (2008); S.S. Yu, W.R. Meier, R.P. Abbott, J.J. Barnard, T. Brown, D.A. Callahan, C. Debonnel, P. Heitzenroeder, J.F. Latkowski, B.G. Logan, S.J. Pemberton, P.F. Peterson, D.V. Rose, G-L. Sabbi, W.M. Sharp, and D.R. Welch, "An Updated Point Design for Heavy Ion Fusion" Fusion Science and Technology," Vol. 44, 266-273 (September 2003); W.R. Meier, "Systems Modeling for Z-IFE Power Plants," *Fusion Eng. and Design*, Vol. 81, 1661 (2006); W.R. Meier, "Osiris and Sombrero Inertial Fusion Power Plant Designs-Summary, Conclusion, and Recommendations," *Fusion Eng. Des.*, Vol. 25, 145-157 (1994), ; L.M. Waganer, "Innovation Leads the Way to Attractive Inertial Fusion Energy Reactors—Prometheus-L and Prometheus-H," *Fusion Eng. Des.*, Vol. 25, 125-143 (1994).

[26] Hagop Injeyan and Gregory D. Goodno, *High-Power Laser Handbook*, McGraw Hill, 2011.

[27] Experience in preparations for the NIF shows that physical variations among targets and shots are likely to produce significant gain variations. One needs the highest feasible nominal gain and the highest feasible driver energy to minimize the effects of these variations.

gain may lead to reduced target costs because, for fixed driver energy, fewer targets would be required to produce a given quantity of energy. Finally, there are often important limits on chamber repetition rate. Increasing target gain, for a given driver energy and a given plant capacity, leads to lower repetition rates.

6 Conclusions and Recommendations

Based on the information gathered by the committee through its first four meetings, its site visits, and on its own analysis, the following is a summary of the committee's preliminary conclusions and recommendations.

Conclusion 1: The scientific and technological progress in inertial confinement fusion has been substantial during the past decade, particularly in areas pertaining to the achievement and understanding of high-energy-density conditions in the compressed fuel, in numerical simulations of inertial confinement fusion processes, and in exploring several of the critical technologies required for inertial fusion energy applications (e.g., high-repetition-rate lasers and heavy-ion-beam systems, pulsed-power systems, and cryogenic target fabrication techniques).

Despite these advances, however, many of the technologies needed for an integrated inertial fusion energy system are still at an early stage of technological maturity. For all approaches to inertial fusion energy examined by the committee (diode-pumped lasers, KrF lasers, heavy-ion accelerators, pulsed power; indirect drive, and direct drive), there remain critical scientific and engineering challenges associated with establishing the technical basis for an inertial fusion energy demonstration plant. In addition, cost estimates for the R&D program leading to an inertial fusion energy demonstration plant are also at an early stage of development. For example, for energy applications, considerable R&D remains to be carried out in the containment of fusion energy releases at high repetition rates, and in improving the performance of the reactor components over long periods of time.

Conclusion 2: It would be premature at the present time to choose a particular driver approach as the preferred option for an inertial fusion energy demonstration plant.

The committee recognizes, of course, that such a down-selection among options will eventually have to be made. In its final report, the committee will provide examples of key experimental results that will be needed to inform the decision points regarding which driver-target combinations are most likely to succeed.

The committee notes with favor that the inertial confinement fusion community has begun a process to develop community consensus on critical issues and future inertial

fusion energy activities in the United States.[28] This important effort should be encouraged, with the overall goal of developing options for a community-based roadmap for the development of inertial fusion as a practical energy source. Increasing the involvement of the university inertial confinement fusion community, as well as drawing on a broader set of technical expertise in micro-fabrication, materials, laser, accelerator, and pulsed-power disciplines, would greatly strengthen this effort.

The NIF has been focused on demonstrating ignition in order to achieve its stockpile stewardship mission, and, as such, no shots have been devoted primarily to inertial fusion energy research. Furthermore, the NIF laser, targets, shot repetition rate, production methods, and materials are not specifically designed to be suitable for inertial fusion energy applications. Nevertheless, many experiments that could be done using the NIF would be valuable for inertial fusion energy even if the achievement of ignition is delayed—particularly those that provide experimental validation of predictive capabilities.

The above discussion led the committee to make the following recommendation.

Recommendation: Planning should begin for making effective use of the National Ignition Facility as one of the major program elements in an assessment of the feasibility of inertial fusion energy.[29]

7 Path Forward to Complete the Final Report

This interim report provides an overview of the committee's preliminary conclusions and recommendations based on information gathered through its first four meetings. The committee is mindful that inertial fusion science and technology are evolving rapidly, and an effort has thus been made not to draw technical conclusions in the interim report that may change by the time the final report is issued in the summer of 2012. Thus, the interim report is intended to provide the sponsor with a relatively robust sense of the direction of the committee's assessment and to assist the Department of Energy in planning future-year budget requests for inertial fusion energy, while maintaining the discussion at a moderately high level. After completing its data gathering and analysis process in future meetings, the committee will provide a more detailed description of its

[28] "In January of 2010 representatives from the major National Nuclear Security Administration (NNSA) Inertial Confinement Fusion (ICF) institutions were challenged by Christopher Deeney, Director of the Office of Inertial Confinement Fusion ICF and Kim Budil, Senior Advisor to the DOE Under Secretary for Science, to develop a consensus position on inertial fusion energy in preparation for the upcoming National Academy of Sciences (NAS) review." The result was reported by M. Hockaday et al., "White Paper Compilation on Inertial Fusion Energy (IFE) Development (U)," LA-UR 11-01934, 2011.

[29] A similar recommendation was made in FESAC: A Plan for the Development of Fusion Energy, March 2003.

final findings and recommendations alongside its full assessment of the prospects for inertial fusion energy with regard to each of the bulleted tasks in Appendix B. The committee's final report is planned to include as an appendix an unclassified version of the Target Physics Panel Report.[30]

[30] The role of the Target Physics Panel is explained in the Preface. Meeting agendas from the Target Physics Panel's first four meetings are attached to this interim report as Appendix F.