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

HEARING CHARTER

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

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

1. Purpose

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

2. Witness

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

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4. Overview

Overall Budget

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

Research and Development (R&D) Budget

Overall Federal Research and Development Spending[2]

(dollars in millions)

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

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

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

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

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

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

5. Interagency Research Activities[4]

Interagency Research Activities Spending

(dollars in millions)

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

National Nanotechnology Initiative (NNI)

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

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

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

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

Networking and Information Technology R&D (NITRD)

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

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

U.S. Global Change Research Program (USGCRP)

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

6. Agency R&D Highlights

National Aeronautics and Space Administration (NASA)

National Aeronautics and Space Administration (NASA) Spending

(dollars in millions)

Account	FY11 Actual	FY12 Estimate	FY13 Request	FY13 Request versus FY12 Estimate	
				$	%
Science Mission Directorate	**4919.7**	**5073.7**	**4911.2**	**(162.5)**	**-3.2**
Earth	*1721.9*	*1760.5*	*1784.8*	*24.3*	*1.6*
Planetary	*1450.8*	*1501.4*	*1192.3*	*(309.1)*	*-20.6*
Astrophysics	*631.1*	*672.7*	*659.4*	*(13.3)*	*-2.0*
James Webb Space Telescope	*476.8*	*518.6*	*627.6*	*109.0*	*21.0*
Heliophysics	*639.2*	*620.5*	*647.0*	*26.5*	*4.2*
Aeronautics	**533.5**	**569.4**	**551.5**	**(17.9)**	**-3.1**
Space Technology	**456.3**	**573.7**	**699.0**	**125.3**	**21.8**
Exploration	**3821.2**	**3712.8**	**3932.8**	**220.0**	**5.9**
Exploration Systems Development	*2982.1*	*3007.1*	*2769.4*	*(237.7)*	*-7.9*
Commercial Spaceflight	*606.8*	*406.0*	*829.7*	*423.7*	*104.3*
Exploration R&D	*232.3*	*299.7*	*333.7*	*34.0*	*11.3*
Space Operations	**5146.3**	**4187.0**	**4013.2**	**(173.8)**	**-4.1**
Space Shuttle	*1592.9*	*556.2*	*70.6*	*(485.6)*	*-87.3*
International Space Station	*2713.6*	*2829.9*	*3007.6*	*177.7*	*6.2*
Space and Flight Support	*839.8*	*800.9*	*935.0*	*134.1*	*16.7*
Education	**145.4**	**136.1**	**100.0**	**(36.1)**	**-26.5**
Cross Agency Support	**2956.4**	**2993.9**	**2847.5**	**(146.4)**	**-4.8**
Center Management &Operation	*2189.0*	*2204.1*	*2093.3*	*(110.8)*	*-5.0*
Agency Management & Operations	*767.4*	*789.8*	*754.2*	*(35.6)*	*-4.5*
Construction & Environmental Compliance	**432.9**	**487.0**	**619.2**	**132.2**	**27.1**
Construction of Facilities	*373.3*	*441.3*	*552.8*	*111.5*	*25.3*
Environmental Compliance	*59.6*	*45.6*	*66.4*	*20.8*	*45.6*
Inspector General	**36.3**	**38.3**	**37.0**	**(1.3)**	**-3.4**
Totals:	**18448.0**	**17770.0**	**17711.4**	**(58.6)**	**-0.3**

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

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

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

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

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

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

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

Department of Energy (DOE)

Department of Energy (DOE) Spending

(dollars in millions)

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

*Minor and non-S&T-related accounts at SC and EERE are not shown.

**Formerly known as Industrial Technologies Program.

***Includes Reactor Concepts RD&D, Fuel Cycle R&D, Integrated University Program, LWR SMR Licensing Technical Support, International Nuclear Energy Cooperation's, and Nuclear Energy Enabling Technologies.

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

Office of Science (SC)

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

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

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

Advanced Research Projects Agency – Energy (ARPA-E)

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

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

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

Nuclear Energy

The primary mission of the Office of Nuclear Energy (NE) is to "advance nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research,

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

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

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

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

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

Energy Efficiency and Renewable Energy (EERE)

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

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

Electricity Delivery and Energy Reliability

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

[7] Department of Energy, *"Office of Nuclear Energy: Our Mission,"* Accessible at: http://nuclear.energy.gov/neMission.html
[8] *DOE Budget Highlights*, p. 43.
[9] Department of Energy, *"EERE Program Plans, Implementation, & Results.*" Accessible at: http://www1.eere.energy.gov/pir/corporate.html

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

Fossil Energy

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

Within the FE R&D program, the budget request reduces coal R&D to $275.9 million, a decrease of $92.5 million or 25.1 percent below FY12 levels. The Natural Gas Technologies R&D program request is $17 million, $12 million of which is proposed for a new interagency R&D initiative by DOE, EPA, and the U.S. Geological Survey to "understand and minimize the potential environmental, health, and safety impacts of shale gas development through hydraulic fracturing…including the key research recommendations received from the Subcommittee of the Secretary of Energy Advisory Board."[12] The Coal and Coal Biomass to Liquids, Solid Oxide Fuel Cells, and Unconventional Fossil Energy Technologies programs are all eliminated in the request.

Energy Innovation Hubs

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

Loan Guarantee Program Office

Title 17 of the Energy Policy Act of 2005 authorizes DOE to make loan guarantees to encourage early commercial use of new or significantly improved technologies in energy projects. Projects supported must avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases; employ new or significantly improved technologies; and offer a reasonable prospect of repayment of the principal and interest on the guaranteed obligation.
According to the budget request, the Loan Guarantee Program has awarded over $16 billion in loan guarantees for 26 renewable energy projects, and has made additional commitments that

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

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

National Science Foundation (NSF)

National Science Foundation (NSF) Spending

(dollars in millions)

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

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

Research and Related Activities (RRA)

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

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

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

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

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

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

Education and Human Resources (EHR)

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

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

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

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

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

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

Major Research Equipment and Facilities Construction (MREFC)

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

National Institute of Standards and Technology (NIST)

National Institute for Standards and Technology (NIST) Spending

(dollars in millions)

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

**in FY11 funded under STRS account*

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

Research and Facilities

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

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

Industrial Technology Services (ITS)

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

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

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

National Network for Manufacturing Innovation

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

Wireless Innovation Fund

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

National Oceanic and Atmospheric Administration (NOAA)

National Oceanic and Atmospheric Administration (NOAA) Spending

(dollars in millions)

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

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

NOAA Line Offices

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

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

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

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

Department of Homeland Security (DHS)

Department of Homeland Security (DHS) Spending

(dollars in millions)

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

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

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

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

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

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

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

Environmental Protection Agency (EPA)

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

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

*Does not include transfer from Superfund account.

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

7. STEM Education across the Federal Government

Federal STEM Education Funding By Agency

(dollars in millions)

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

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

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

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

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

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