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

HEARING CHARTER

The Department of Energy Fiscal Year 2011 Research and Development Budget Proposal

Wednesday, March 3, 2010
12:00 p.m. – 2:00 p.m.
2318 Rayburn House Office Building

PURPOSE

On Wednesday, March 3, 2010, the Committee on Science and Technology will hold a hearing entitled "***The Department of Energy Fiscal Year 2011 Research and Development Budget Proposal."*** The purpose of the hearing is to receive testimony from the Secretary of Energy on the President's Fiscal Year 2011 budget request for energy research and technology development programs at the Department, including activities under the Offices of Science, Energy Efficiency and Renewable Energy, Fossil Energy, Nuclear Energy, Electricity Delivery and Energy Reliability, the Advanced Research Projects Agency –Energy, and the Loan Guarantee Program.

WITNESS

- **Dr. Steven Chu,** *U.S. Secretary of Energy*. Prior to his appointment as the 12th Secretary of Energy, Dr. Chu was the Director of DOE's Lawrence Berkeley National Laboratory, and a professor of Physics and Molecular and Cell Biology at the University of California. Dr. Chu was the co-winner of the 1997 Nobel Prize for Physics.

BACKGROUND

The Fiscal Year 2011 budget request for the Department of Energy is $28.4 billion, which represents a $1.8 billion or 6.8 percent increase over FY 2010. This supports a wide range of activities within the DOE mission, including maintaining nuclear weapons deterrence capabilities, securing nuclear materials, improving energy efficiency, incentivizing production of renewable energy, curbing greenhouse gas emissions, and investing in research and innovation to enhance the nation's economic competitiveness. The FY 2011 budget request builds on $36.7 billion in funding from the American Recovery and Reinvestment Act of 2009 which is expected to be completely obligated by the end of FY 2010.

Of the total budget for DOE, approximately one-third is allocated for civilian energy research and technology development programs within the Science and

Technology Committee's jurisdiction. The remainder is designated for weapons stockpile stewardship and nonproliferation activities in the National Nuclear Security Administration (NNSA) as well as both Defense and Non-Defense Environmental Cleanup (EM).

The FY 2011 budget request continues support for crosscutting initiatives that draw on the various program offices within DOE, including both new and existing proposals for Energy Innovation Hubs, and science and engineering education activities through RE-ENERGYSE (Regaining our ENERGY Science and Engineering Edge).

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

The Fiscal Year 2011 budget request for ARPA-E is $299.9 million. This will be the first year that ARPA-E receives full operational funding through the annual appropriations process. ARPA-E was established in 2009 with $15 million from the Omnibus Appropriations Act of 2009 and $400 million from the American Recovery and Reinvestment Act of 2009.

ARPA-E was originally authorized in the America COMPETES Act of 2007 (P.L. 110-69). That Act followed on the direct recommendations of the National Academies seminal 2005 report, "*Rising Above the Gathering Storm.*" The Gathering Storm panel was chaired by retired Lockheed Martin Chairman and CEO Norman Augustine, and included, among a number of notable experts Secretary Chu. The panel made a recommendation to create a new energy research agency (ARPA-E) within the Department of Energy patterned after the successful Defense Advanced Research Projects Agency (DARPA) within the Department of Defense.

According to the Gathering Storm report, ARPA-E should be structured to "sponsor creative, out-of-the-box, transformational, generic energy research in those areas where industry itself cannot or will not undertake such sponsorships, where risks and potential payoffs are high, and where success could provide dramatic benefits for the Nation…. It would be designed as a lean, effective, and agile—but largely independent—organization that can start and stop targeted programs based on performance and ultimate relevance."

Shortly after receiving Recovery Act funding, ARPA-E released its first Funding Opportunity Announcement (FOA) in April 2009, and it received an unprecedented response of almost 3,700 concept papers. After an intensive selection process utilizing expert volunteers from industry and academia, 334 of those were chosen to submit full applications. Ultimately, 37 projects were chosen to participate, totaling over $150 million in awards to a diverse range of technologies and performers.

A second round of solicitations totaling $100 million was announced in early December. Informed by a series of open workshops the second round focuses on three distinct areas: innovative materials and processes for carbon capture, transportation

batteries, and liquid fuels from carbon dioxide. Despite the comparatively narrow scope of this solicitation, ARPA-E received over 600 concept papers. It is expected that awards will be announced in the coming this spring, and total 30-40 projects. A third round of solicitations is expected soon.

Given the high demand evidenced by the responses to the first and second rounds of funding, DOE and ARPA-E leadership acknowledged that it had the capacity to accommodate only a small percentage of applications. Consequently, the Department is hosting an ARPA-E Energy Innovation Summit on March 1-3rd to highlight some award-winning projects as well as those that did not receive awards but would likely still be of interest to the investor community.

OFFICE OF SCIENCE

The FY 2011 budget request for the DOE Office of Science is $5.1 billion. This represents an increase of $218 million or 4.4 percent over the FY2010 enacted level of funding.

The request for **Basic Energy Sciences (BES)** is $1.84 billion, an increase of $198.5 million or 12.1 percent over enacted FY 2010 funding. As the largest program within the Office of Science, BES conducts research and supports major user facilities to examine the cross-cutting areas of materials and chemical sciences. In FY 2009, the program began support for 46 Energy Frontier Research Centers (EFRCs) focusing on specific research areas for energy applications that were identified in a series of recent reports and workshops. The annual budget for each EFRC is $2-5M per year, and each supports ~6-12 researchers from a variety of institutions. In FY 2010, DOE is initiating an Energy Innovation Hub on producing liquid transportation fuels directly from sunlight, carbon dioxide, and water through a chemical process analogous to photosynthesis in plants, but without the need to maintain life processes. The Hub was funded in FY 2010 by DOE's Office of Energy Efficiency and Renewable Energy in accordance with the FY 2010 Energy & Water Development Appropriations Act, but it is being managed by BES. In FY 2011, DOE has proposed to formally fund this Hub through BES as well. In addition, DOE is proposing the establishment of a Hub on Batteries and Energy Storage in BES, with a request of $34 million for FY 2011. Energy Innovation Hubs have annual budgets of ~$25 million, and will be able to support much larger research teams than EFRCs. No federal funds for EFRCs or Hubs can be used for construction of permanent infrastructure, and all awardees must recompete every five years.

The budget would provide $426 million for **Advanced Scientific Computing Research (ASCR)**, an increase of $32 million or 8.1 percent over enacted FY 2010 funding. This includes funds to continue upgrading the Leadership Class Facilities at Oak Ridge National Laboratory and Argonne National Laboratory.

Biological and Environmental Research (BER) would receive $626.9 million under the President's budget, which is $22.7 million or 3.8 percent over current year

funding. In addition to the role of BER in areas such as genomics, climate change research, and environmental remediation, the FY 2011 request supports continued funding for three bioenergy research centers established in FY 2008.

The request for **Fusion Energy Sciences (FES)** is $380 million, a decrease of $46 million or 10.8 percent below enacted FY 2010 funding. This decrease largely reflects a one-year reduction in the U.S. contribution to the ITER international fusion project, from $135 million to $80 million, consistent with the project's current status as a final design is determined this year.

The FY 2011 funding request for **High Energy Physics (HEP)** is $829 million, which is $18.5 million or 2.3 percent more than the enacted FY2010 level. This program conducts fundamental research in elementary particle physics and accelerator science and technology, including support for research on collaborative international projects such as the Large Hadron Collider.

Nuclear Physics (NP) would receive $562 million, an increase of $27 million or 5 percent over FY 2010 funding. NP supports research to discover and understand various forms of nuclear matter. It also supports the production and development of techniques to make isotopes that are in short supply for medical, national security, environmental, and other research applications.

Energy Efficiency and Renewable Energy (EERE)

The President's proposal of $2.35 billion for the Office of Energy Efficiency and Renewable Energy at the Department of Energy represents a 5% increase from the enacted FY 2010 level. Under this request renewable energy investments would significantly increase for large-scale demonstrations in biopower, concentrating solar power, offshore wind, and advanced hydropower. Energy efficiency activities would continue to support R&D for innovative new building technologies and a new focus on retrofitting existing buildings. For the second year in a row the Administration is including a proposal to fund a new program coordinated with the National Science Foundation called RE-ENERGYSE. This would provide educational and training support to universities and community colleges.

The proposed funding for the **Solar Energy** program is $302.4 million, an increase of $55.4 million or 22.4 percent over FY 2010 levels. This reflects an increase of $23.5 million to the Photovoltaic R&D subprogram covering the first full year of funding for its PV Manufacturing Initiative, a $48.5 million increase to the Concentrating Solar Power subprogram to accelerate the installation of large-scale solar thermal demonstration projects in the American Southwest, and a proposed shift of support for the Fuels from Sunlight Energy Innovation Hub from EERE to the Office of Science, as described above.

The FY 2011 funding request for the **Wind Energy** program is $122.5 million, an increase of $42.5 million or 53.1 percent. This increase primarily reflects the establishment of a significant subprogram to accelerate the advancement of offshore wind through demonstrations and technology development.

The FY2011 **Biomass and Biorefinery Systems** request would stay flat at $220 million. This program seeks to produce cost-competitive renewable fuels from biomass feedstocks, (grass, trees etc.) through the advancement of technologies and practices to make the entire biomass supply chain more efficient. In coordination with the Office of Fossil Energy, the program will also establish a new $50 million biopower initiative to accelerate the commercialization of technologies which produce electricity and heat from biomass.

The **Buildings Technologies Program** (BTP) would receive $231 million, a 3.9 percent increase over FY 2010 enacted levels. This includes an increased emphasis on technology research and development for retrofitting the nation's existing building portfolio. The program will also focus on promoting the use of more efficient appliances. The Buildings Technology program seeks to complete legally required efficiency standards pursuant to the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007. Standards will be issued for a variety of appliances and equipment including fluorescent lamp ballasts, clothes dryers, residential refrigerators, furnaces and boilers.

Additionally, the request includes $24 million for the Energy Efficient Buildings Systems Design Hub. This will focus on state-of-the-art energy science and technologies that integrate smart materials, designs, and systems to increase energy efficiency in buildings. This approach would maximize the efficiency of different components and systems in a building. This Hub would be a part of the Administration's proposed Energy Regional Innovation Cluster (E-RIC), a multi-agency initiative to spur regional economic growth while making buildings more energy efficient. This initiative involves six federal agencies and up to $129.7 million over five years to create a regional research center that will develop new building efficiency technologies and work with local partners to implement these technologies in area buildings.

The Administration's budget request would provide a total of $40 million for the **Water Power** program. This provides support to advance both conventional hydropower and marine and hydrokinetic (MHK) technologies, each with $20 million for FY2011. This request is $30 million below the explicit $50 million authorization in the EISA for R&D for MHK technologies. The $20 million request for FY2011 is also below the FY2010 appropriation of close to $40 million for MHK technologies.

The proposed funding level for the **Geothermal Technology** program is $55 million, up by $10 million from the FY2010 appropriation, but still $35 million below the $90 million authorized from EISA. This funding will continue the Department's focus on Enhanced Geothermal Systems (EGS), including three existing EGS demonstration projects, and add three new projects.

The **Industrial Technologies Program** would receive $100 million, an increase of $4 million from the FY2010 appropriation. The program focuses on reducing energy-intensity by 25 percent in the U.S. industrial sector by 2017, a goal established by EPAct '05. This funding will focus on new initiatives in the chemical and cement industries and continue activities in other energy-intensive industry sectors, while also focusing more attention on crosscutting activities. Specifically, the program will continue to support Combined Heat and Power (CHP) activities in the industrial sector through its existing projects funded through Recovery Act funds and new R&D on cutting edge technologies.

Nuclear Energy (NE)

For FY 2011 the Administration requests $503 million for the Office of Nuclear Energy research and development, representing an increase of $37 million over the FY 2010 enacted funding level. Close to eighty percent of that request is dedicated to the **Fuel Cycle Research and Development** and **Reactor Concepts RD&D** programs. The Administration recently expressed support for the expansion of nuclear power, and increased its commitment to loan guarantees for new reactors as well as commissioned a Blue Ribbon panel to consider long-term strategies for used nuclear fuel and waste storage.

The United States has been conducting research on the reprocessing of spent nuclear fuel since 2002 under the Advanced Fuel Cycle Initiative and more recently under the Fuel Cycle Research and Development program. In April 2009, the Administration signaled a change in this initiative when it announced it was no longer pursuing domestic commercial reprocessing under the Global Nuclear Energy Partnership (GNEP) program, which had sought near-term reprocessing technology development and deployment. GNEP had drawn criticism based on the substantial costs estimated for implementing the program and the technical challenges associated with developing, demonstrating, and deploying advanced technologies for recycling spent nuclear fuel that do not separate out a stream of weapons-ready plutonium. The National Academies expressed similar concerns in a series of reports. The new strategy of this program will be to examine three distinct fuel cycle strategies: once-through, modified-open, and full-recycle.

The Administration reorganized NE's advanced reactor research efforts and created the Reactor Concepts RD&D program. This new program will include Generation IV Nuclear Energy Systems, Next Generation Nuclear Power, a new focus on Small Modular Reactor design, and other advanced reactor initiatives. The Administration recognized that advanced reactor design is a vital part of closing the fuel cycle and increasing the efficiency and longevity of both the current nuclear fleet and those plants expected to be built in the near-term. Furthermore, next generation advanced reactors are expected to provide the capacity to utilize advanced fuels reclaimed through reprocessing.

The FY2011 budget request also establishes the Nuclear Energy Enabling Technologies (NEET) program to provide support to the aforementioned programs and develop crosscutting technologies. Amongst the goals of this program will be exploration of advanced fuels and concepts that will increase the performance of technologies developed in the Reactor Concepts RD&D and Advanced Fuel Cycle Initiative programs. NEET will also encourage research into high-risk, high-reward concepts aimed at providing technological leaps for nuclear generation. Furthermore, under the NEET program, the Administration provides $24.3 million for the Energy Innovation Hub for Modeling and Simulation. This hub program will continue its 2010 work in providing validated advanced modeling and simulation tools necessary to enable fundamental changes in how the U.S. designs and licenses nuclear power and waste management technologies.

An additional $5 million is requested for RE-ENERGYSE under the Nuclear Energy Program.

Fossil Energy R&D

The proposed FY 2011 budget includes a significant reduction for Office of Fossil Energy (FE) funding. The Fossil Energy R&D program would receive $587 million in FY 2011, a decrease of $85 million compared to FY 2010 appropriations. Pursuant to the Administration's policy to cut oil and gas subsidies the reduction comes largely from the proposed cancellations of the Natural Gas Technologies program and the Unconventional Fossil Energy Technologies program as well as no planned FY 2011 Congressionally Directed Projects. Coal-related projects would receive $404 million, similar to FY2010's funding levels.

The FY 2011 budget request for FE's Coal program will be a driver to accomplish the Administration's recently announced pledge to develop 5-10 Carbon Capture and Sequestration (CCS) demonstration projects by 2016. The Fuels and Power Systems program initiatives will focus on research, development, and deployment of technologies to use fossil fuels more cleanly and efficiently. This program also supports demonstration projects including the Clean Coal Power Initiative (CCPI) and FutureGen, though both of those programs will not receive funding for demonstrations under the FY2011 plan, and instead FE will focus on project execution in all Rounds of CCPI and completion of National Environmental Policy Act (NEPA) procedures for ongoing projects. Included in this request is $143.0 million for FE's Carbon Sequestration program including the Regional Carbon Sequestration Partnerships, $65 million for the Innovations for Existing Plants program, and $55 million for the Advanced Integrated Gasification Combined Cycle (IGCC) program. The Administration will continue to explore fuel cell and advanced turbine technologies for deployment in central coal power generation facilities. Furthermore, the Advanced Research program would receive $47.9 million for its continued activities to improve efficiency and reduce costs of advanced coal-based systems. The Administration will propose a new budget structure for the FY 2012 Clean Coal program to align the four key research areas of efficiency, carbon capture, geologic storage, and cross-cutting research.

Electricity Delivery and Energy Reliability

The Office of Electricity Delivery and Energy Reliability (OE) is charged with managing programs to modernize the electric grid, enhance security and reliability of the energy infrastructure, and facilitate recovery from disruptions to our energy supply. The Administration's FY 2011 request for OE's Research and Development is $144 million, a $19 million increase over last year's funding. Included is additional funding for smart grid and energy storage technologies R&D. Within the smart grid research activities there will be a new focus on power electronics. These activities help utilities effectively deliver power to customers while providing increased reliability to bulk power systems. An integral part of this research will be on promising materials for semiconductors. A funding increase of $26 million for energy storage technology research will be used to initiate activities in community energy systems based on vehicle batteries and the development of significantly larger lithium ion cells for stationary applications. Additionally, increased basic research and improved modeling capacities for Compressed Air Energy Storage (CAES) systems will be conducted. Also notable is a reduction in funding of $10 million for Cyber Security for Energy Delivery Systems.

Loan Guarantee Program

The FY 2011 budget request proposes funding and authority to support approximately $40 billion in additional loan guarantees for renewable energy, energy efficiency, and nuclear energy projects.

FY 2011 Budget Request - Department of Energy Research and Development Programs

Programs	FY 09 Approp	ARRA	FY 10 Budget Rqst	FY 10 Approp	FY 11 Budget Rqst	% +/- Over FY 10 Approp
Energy Efficiency and Renewable Energy	**1928.5**	**16800**	**2318.6**	**2243**	**2355.5**	**5.0%**
Fuel Cell Technology			68.2	0		
Hydrogen Technology	169			174	137	-21.3%
Biomass and Biorefinery Systems	217	800	235	220	220	0.0%
Solar Energy	175		320	225	302.4	34.4%
Wind Energy	55		75	80	122.5	53.0%
Geothermal Technology	44	400	50	44	55	25.0%
Water Power	40		30	50	40.5	-19.0%
Vehicle Technologies	273.2		333.3	311.4	325.3	4.5%
Building Technologies	140		237.7	200	230.7	15.4%
Industrial Technologies	90		100	96	100	4.2%
Federal Energy Management Program	22		32.3	32	42.3	32.2%
Energy Education and Workforce Training (RE-ENERGYSE)			115	0	50	
Facilities and Infrastructure	76		63	63	57.5	-8.7%
Program Direction & Support	145.8		358.1	185	287.3	55.3%

Programs	FY 09 Approp	ARRA	FY 10 Budget Rqst	FY 10 Approp	FY 11 Budget Rqst	% +/- Over FY 10 Approp
Electricity Delivery and Energy Reliability						
Research and Development	84.7	4500	174	124.9	144.3	15.5%
Nuclear Energy R & D	515		403	503	503	0.0%
Generation IV Nuclear Energy Systems	180		191	220.1	*	
Fuel Cycle R & D (formerly Advanced Fuel Cycle Initiative)	145		192	136	201	47.8%
Reactor Concepts R & D					195	
Reenergyse					5	
Nuclear Energy Enabling Technologies					99.3	

* Generation IV funding included in Reactor Concepts R & D

Fossil Energy R & D	876.3	3400	617.6	672.4	586.6	-12.8%
Coal	692.4		403.9	404	403.9	0.0%
Carbon Sequestration	288.2		0			
Fuels and Power Systems	404.2		403.9	404		
Natural Gas Technologies	20		25	17.8	0	
Unconventional Fossil Energy Technologies				20	0	
Program Direction	152		158	158	152	-3.8%
Special Recruitment Programs	0.7		0.7	0.7	0.7	0.0%
Plant and Capital Equipment	18		20	20	20	0.0%
Fossil Energy Environmental Restoration	9.7		10	10	10	0.0%
Cooperative Research and Development				5	0	
Office of Science	4772.6	1600	4941.7	4903.7	5121.4	4.4%
High Energy Physics	795.7		819	810.5	829	2.3%
Nuclear Physics	512.1		552	535	562	5.0%
Biological and Environmental Research	601.5		604	604.2	626.9	3.8%
Basic Energy Sciences	1572		1680	1636.5	1835	12.1%
Advanced Scientific Computing Research	368.8		409	394	426	8.0%
Fusion Energy Sciences	402.6		421	426	380	-10.8%
Science Laboratories Infrastructure	145.4		133	127.6	126	-1.3%
Safeguards and Security	80.6		83	83	86.5	4.2%
Science Program Direction	186.7		214	189.4	214.4	13.2%
Science Workforce Development	13.6		21	20.7	35.6	48.5%
ARPA-E	15	400	10	0	300	