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PRIORITIES IN THE DEPARTMENT OF ENERGY BUDGET FOR FISCAL YEAR 2006

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY

COMMITTEE ON SCIENCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED NINTH CONGRESS

FIRST SESSION

APRIL 27, 2005

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April 27, 2005

Appendix: Answers to Post-Hearing Questions

PRIORITIES IN THE DEPARTMENT OF ENERGY BUDGET FOR FISCAL YEAR 2006

WEDNESDAY, APRIL 27, 2005

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY,
COMMITTEE ON SCIENCE,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:11 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Judy Biggert [Chairman of the Subcommittee] presiding.

COMMITTEE ON SCIENCE
SUBCOMMITTEE ON ENERGY
U.S. HOUSE OF REPRESENTATIVES

Priorities in the Department of Energy Budget for Fiscal Year 2006

Wednesday, April 27, 2005

10:00 AM – 12:00 PM
2318 Rayburn House Office Building

Witness List

Dr. Raymond L. Orbach
Director of the Office of Science
The Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Mr. Douglas Faulkner
Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy
The Department of Energy
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Mr. Mark R. Maddox
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Washington, DC 20585

Mr. Robert Shane Johnson
Deputy Director for Technology, the Office of Nuclear Energy, Science and Technology
The Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Mr. Kevin Kolevar
Director of the Office of Electricity Delivery and Energy Reliability
The Department of Energy
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Washington, DC 20585

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HEARING CHARTER

SUBCOMMITTEE ON ENERGY
COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

Priorities in the Department of Energy Budget for Fiscal Year 2006

WEDNESDAY, APRIL 27, 2005
10:00 A.M.—12:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

1. Purpose

On Wednesday, April 27, 2005, the Energy Subcommittee of the House Science Committee will hold a hearing on the Department of Energy's fiscal year 2006 (FY06) budget request.

2. Witnesses

- **Dr. Ray Orbach** is the Director of the Office of Science at DOE. He has held this position since 2002. Prior to joining the Department, Dr. Orbach was Chancellor of the University of California at Riverside.
- **Mr. Douglas Faulkner** is the Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy (EERE). Before assuming his post in EERE, Mr. Faulkner's federal career included service as a senior policy advisor to two Secretaries of Energy.
- **Mr. Mark R. Maddox** is the Principal Deputy Assistant Secretary for Fossil Energy (FE) at DOE. Prior to joining FE, Mr. Maddox served as Senior Policy Advisor to the Secretary of Energy. Prior to coming to DOE in 2003, Mr. Maddox was Director of Communications and Public Affairs for a division of Lockheed Martin, Inc. that is now called Affiliated Computer Services State and Local Solutions, Inc.
- **Mr. Robert Shane Johnson** is the Deputy Director for Technology, the Office of Nuclear Energy, Science and Technology. He has previously served as Associate Director for Advanced Nuclear Research, and as the Associate Director for Technology and International Cooperation. Prior to coming to DOE, he was employed with Duke Power Company and Stoner Associates, Inc.
- **Mr. Kevin Kolevar** is the Director of the recently renamed Office of Electricity Delivery and Energy Reliability (a merger of the Office of Electricity Transmission and Distribution, and the Office of Energy Assurance) at DOE. Prior to his appointment, Kolevar served as Chief of Staff to then-Deputy Secretary of Energy Kyle McSlarrow, and as a senior advisor to the U.S.-Canada Task Force that investigated the 2003 blackout. Before coming to DOE, Kolevar served on the staffs of Senators Spencer Abraham and Connie Mack.

3. Overarching Questions

- How does the Department determine the appropriate balance between near- and longer-term technologies in its applied programs? When technologies are proven and ready for wider use, how does the Department help get them into the marketplace? What is the appropriate role for industry in this effort?
- How is White House guidance to science and technology agencies reflected in the activities funded by the DOE budget? In particular, does the DOE budget reflect the emphasis on potentially high-payoff activities that will help achieve the long-term national goals of security and energy independence? Should other policy considerations, such as current energy prices and supplies, factor into these decisions?
- In addition, there are a series of program-specific concerns that the Committee would like to explore. See the specific issue areas and Questions to Witnesses in Section 5.

4. Background and Issues

(Background and issues are presented for DOE as a whole and then for each of the programs on which the hearing will focus.)

A) OVERALL DOE R&D

BACKGROUND:

The $5.4 billion DOE R&D funding request for FY06 is divided among the five offices represented at this hearing: The Office of Science (SC) funds basic research at universities and 10 National Laboratories. The Office of Science contributes over 40 percent of all federal funds for civilian physical sciences research. The other four offices run applied R&D programs.

U.S. Energy Context: The applied energy R&D request of $1.95 billion represents 3.1 percent of the civilian science and technology budget.[1] The research is designed to affect the energy sector of the economy, which constituted 7.2 percent of the gross domestic product (GDP) in 2002.[2] Energy may have an even larger influence on policy than its direct economic impact, due to its implications for foreign policy, and because virtually every other product or service in the economy requires some input of energy for its production and/or delivery.

DOE R&D in Budget Context: The President is proposing to spend $60.8 billion on all civilian R&D in the fiscal year (FY) 2006 budget, or about 2.3 percent of the total proposed $2.57 trillion budget.[3] Of the amount proposed for total civilian R&D, 8.9 percent would go to DOE. Table 1 below breaks down the proposed DOE R&D budget.

Table 1. Fiscal Year 2005 and Fiscal Year 2006 Funding for DOE Non-Defense R&D

Account	FY05 appropriation (in millions) *	FY06 Request (in millions)	Percentage Change from FY05 Level
Science	$3,600	$3,463	-3.8%
EERE R&D	$1,029	$975	-5.3%
Efficiency R&D	$643	$621	-3.4%
Renewables R&D	$386	$354	-8.3%
Fossil Energy			
FE R&D	$572	$491	-14.2%
Clean Coal Account**	$-160	$0	
Nuclear Energy R&D	$375	$390	+4.0%
Electricity	$120	$96	-20%
Total	**$5,696**	**$5,415**	**-4.9%**

* The figures in this chart are appropriated amounts for FY05. The Administration sometimes excludes appropriations for earmarks from the FY05 base, resulting in different percentage changes from FY05 to FY06 than are shown here.

**The Clean Coal Technology Account has not received new budget authority since the early 1990s. The FY05 appropriation is the net of an appropriation from prior years of $97 million and a deferral of -$257 million to FY06. The FY06 proposal includes the advance appropriation from FY05 of $257 million, and a rescission of $257 million for a net of zero. The request also includes an advance appropriation of $257 million for FY07.

Source: President's Fiscal Year 2006 Budget Request: *Analytical Perspectives* pp. 66-67, and DOE FY06 Congressional Budget Request.

[1] Not including Department of Homeland Security funding.

[2] Numerator (energy expenditure) from the EIA's Annual Energy Review 2002 Table 3.4 on page 77. Denominator (GDP) from the year 2002 data in the President's 2005 Budget: *Historical Tables,* page 184.

[3] To calculate civilian R&D the Committee began with the Federal Science and Technology (FS&T) budget (*The Budget of the United States: Analytical Perspectives,* pp. 66–67) and subtracted defense and homeland security basic and applied research.

ISSUES:

Does the proposed budget strike the appropriate balance between the physical sciences and the life sciences? Funding for medical and life science research at the National Institutes of Health (NIH) has more than doubled over the past decade, while funding for research in the physical sciences has remained flat (see Figure 1). Given the contribution to the economy of physical science research through technology development and the need in biosciences for the tools created by physics research, some experts fear the balance in federal research funding may have shifted too far. DOE is the largest single funder of non-defense physical science research.

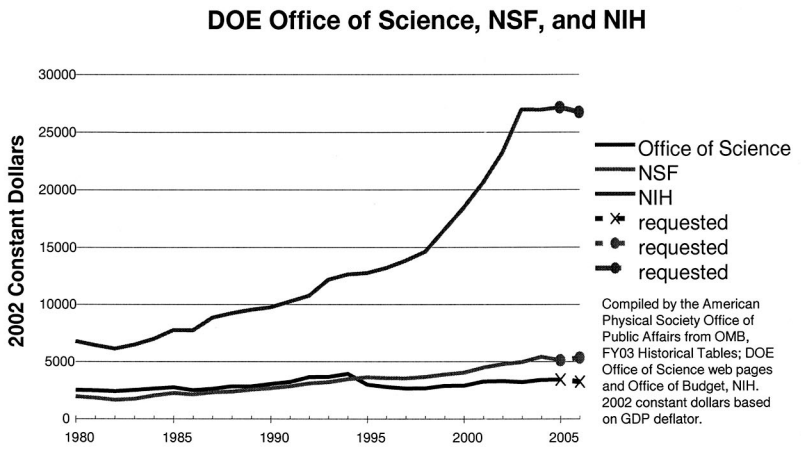

Figure 1: Past 15 years of Funding History for DOE Office of Science, NSF and NIH. This chart shows how funding levels have changed since 1980 for the programs illustrated.

What are the criteria the Department uses to "graduate" activities from the laboratory to the demonstration phase? Demonstration projects are both a useful step in developing technologies and a means to stimulate commercialization of mature technologies. However, in particular programs, such as the hydrogen initiatives and in the FutureGen project, there seems to be an emphasis on very expensive demonstration projects even though there are still major obstacles to be overcome by basic research (i.e., high technical risk). Recently the Department has characterized some of these major projects as "learning demonstrations," and said they are necessary to understand the challenges facing new technologies. The specific characteristics that distinguish a "learning demonstration" from other demonstrations are unclear. It is also unclear whether demonstrations could take place at a smaller scale that would provide the same lessons at a lower price.

Does the proposed budget strike the appropriate balance among applied energy programs? The proposed budget reflects a continuing shift in emphasis away from energy efficiency R&D, with the exception of activities supporting the President's hydrogen initiatives. Other trends are less clear. (See Figure 2.)

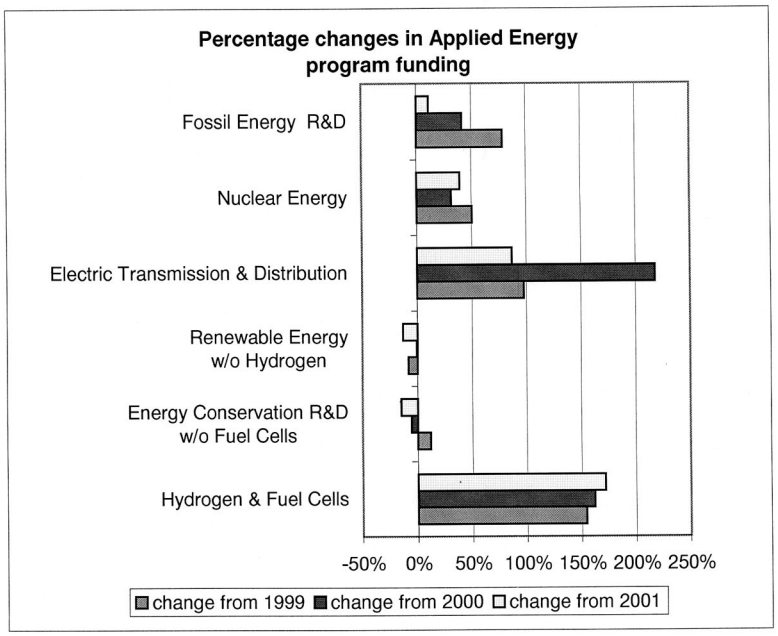

Figure 2. Percentage changes in Applied Energy program funding.
Source: Science Committee analysis of *Department of Energy Congressional Budget Request* Fiscal years 2001, 2002, 2003, and 2006.

Assuming the budget proposal is approved, since FY01, funding for hydrogen and fuel cell activities will have increased by 172 percent; funding for Nuclear Energy, including shifts related to new laboratory costs, will have increased by 39 percent; and funding for Fossil Energy R&D will have increased by 11 percent (even with the elimination of oil and gas R&D programs). Funding for Office of Electricity Delivery and Energy Reliability programs, despite a decline in the request for FY06, will have increased by 87 percent, following a large increase in the wake of the August 2003 blackout. In contrast, funding for Renewable Energy R&D, excluding the Hydrogen fuel initiative, will have dropped by 13 percent; and funding for Energy Efficiency R&D (excluding fuel cells), which received a significant increase in FY02, will have been reduced by 15 percent.

Is the proposed management approach to large demonstration projects such as FutureGen and Next Generation Nuclear Plant the right mechanism to ensure efficient operation and oversight of federally funded projects? The Fossil Energy and Nuclear Energy Offices have chosen a unique management structure for two large demonstration projects. The structure would create private-sector consortia—project integrators—to manage both oversight and operations. One immediate question posed by this proposed arrangement is: what is the liability of the Federal Government in the event that the private-sector partners walk away from the project before the demonstration is completed?

B) OFFICE OF SCIENCE

BACKGROUND:

Table 2. Fiscal Year 2005 and Fiscal Year 2006 Funding for Office of Science

Account	FY05 appropriation (in millions)	FY06 Request (in millions)	$ Change from FY05 Level	Percentage Change from FY05 Level
Total Science	$3,600	$3,463	-$137	-3.8%
HEP	736	714	-22	-3.0%
NP	405	371	-34	-8.5%
BER	582	456	-126	-22%
BES	1,105	1,146	41	3.7%
ASCR	232	207	-25	-11%
FES	274	291	17	6.0%
Other (1)	266	279	13	4.8%

Key to Abbreviations: HEP High Energy Physics, NP Nuclear Physics; BER Biological and Environmental Research; BES Basic Energy Sciences; ASCR Advanced Scientific Computing Research; FES Fusion Energy Science

Budget Highlights: As shown in Table 2, the Administration's FY06 budget request for DOE's Office of Science proposes a reduction of 3.8 percent, from the $3.6 billion FY05 enacted level. The Administration describes this as a 1.6 percent decrease if one excludes $79.6 million in Congressional earmarks. This request is nine percent below the $3.8 billion authorized in H.R. 6, the *Energy Policy Act of 2005,* which was passed by the House on April 21, 2005 by a vote of 249–183.

ISSUES:

If budgets continue to decline, will research grants continue to suffer a disproportionate share of the cuts? Over the last several years, funding from the Office of Science has been approximately equally split between research grants and facilities (both operations and construction). Over the last two years, the proportion of funding for research grants has declined. The proposal for FY06 would exacerbate this trend: the cuts to research grants are proportionally larger than for facilities funding, with research grants cut 10 percent (versus a four percent cut to the Office of Science). If this trend were to continue, DOE's Science programs could potentially change in character, with DOE acting primarily as a facility provider for research activities funded by others. This trend might also have a disproportionate effect on the 15,000 graduate students supported through DOE grants. It is not clear whether DOE has made a deliberate choice to move toward a facility-based program or the emphasis on facilities is a temporary condition to cope with tight budgets.

Do the current trends imply closure of major Office of Science facilities or even an entire National Laboratory? In 2004, the Office of Science released a 20-Year Facilities plan that prioritize the needs of the scientific community over the next two decades. That plan implicitly assumed increases in funding similar to those included in H.R. 6, *Energy Policy Act of 2005* (and its predecessor legislation). The trends in the past two years' budget requests are at odds with the plan. The budget and future projections create a conflict between demand for new facility construction and operation of existing facilities. For example, in the Nuclear Physics budget, the need to operate the Relativistic Heavy Ion Collider (RHIC) at Brookhaven Laboratory and the Continuous Electron Beam Accelerator Facility at the Jefferson Laboratory compete for funds with the plan to construct the Rare Isotope Accelerator facility. Similar competition arises between the proposed international fusion experiment, ITER, and the operation of domestic facilities. DOE has not explained how it will deal with planning for facilities given the tight fiscal environment expected for the next few budget cycles.

How does DOE make tradeoffs between operation of existing facilities and construction of new ones? The emphasis in the FY06 request is on fully funding operations for the newest facilities such as the Spallation Neutron Source ($74 million) and the four new Nanoscale Science Research Centers ($43 million) at Oak Ridge, Sandia, Argonne, and Brookhaven National Laboratories. There are several recently constructed facilities that will have operations severely curtailed, however. For example, RHIC will only operate for 12 weeks under the proposal, seven of which are required for warm-up and calibration activities. This compares with 32

weeks during FY05. As a result, physics activities at this facility will have been reduced by 80 percent.

C) OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

BACKGROUND:

Table 3. Fiscal Year 2005 and Fiscal Year 2006 Funding for Office Energy Efficiency and Renewable Energy

	FY05 appropriation (in millions)	FY06 Request (in millions)	$ Change from FY05 Level	Percentage Change from FY05 Level
Office of EE and RE	$1,248	$1,200	-$48	-4%
Weatherization assistance	$228	$225	-$3	-1%
EERE R&D	$1,020	$975	-$45	-4%
Hydrogen and FreedomCAR in EERE	$254	$283	$29	11%
EERE R&D other than Hydrogen and FreedomCAR	$766	$692	-$74	-10%

Budget Highlights: The largest increase in the account is for the Hydrogen R&D Initiatives, consisting of FreedomCAR and the Hydrogen Fuel Initiative, which total $283 million ($29 million, 11 percent) within EERE. EERE R&D programs excluding hydrogen-related activities were cut by a total of $77 million (-10 percent) to $692 million. Total hydrogen funding at DOE is $358 million, up $48 million (16 percent), including contributions from the program budgets of Fossil Energy ($22 million, up $5 million or 29 percent); Nuclear Energy ($20 million, up $11 million or 124 percent); and Science ($33 million, up $3 million or 11 percent).

ISSUES:

Does the proposed budget achieve the appropriate balance among EERE programs? EERE funds R&D on a range of alternative technologies, including biomass, wind, solar, and geothermal energy. Energy efficiency and renewable energy are important future sources of energy with minimal impact on the environment. Continuing the trend of recent years' budget requests, an increasing amount of EERE funds have been requested for the President's hydrogen initiatives, including fuel and vehicle programs. Since 2001, funding for EERE R&D programs not included in the hydrogen initiatives has decreased by 13 percent. Hydrogen must be made from other energy sources. Renewables and energy efficiency R&D can contribute to the success of the transition to hydrogen: efficiency improvements in vehicles will help reduce the technical challenges facing automakers; and renewables can provide an environmentally friendly energy source for hydrogen manufacture. Both the National Academy of Sciences and the American Physical Society have noted that more R&D will be needed in alternative energy sources to help enable a hydrogen economy and to reduce greenhouse gas emissions. In the event that the technical challenges for hydrogen are too great, renewable biofuels provide one of the few alternatives to foreign oil for transportation.

What are the appropriate roles for government in long-term and near-term R&D? The Administration has emphasized long-range high-risk research as the most important role for government, especially given the well-documented difficulties in securing private funding for long-range R&D. On the one hand, the Committee has been concerned that some long range efforts, like the transition to hydrogen, have skipped over important basic scientific research questions in a rush to commercialization. On the other hand, there appear to be numerous technologies that could benefit from additional technology transfer and deployment activities, yet DOE continues to focus on incremental research. According to the Alliance to Save Energy, technologies exist today that have the potential to save consumers over $4 billion in energy costs per year in 2010. What emphasis should the Department

place on assisting efficiency technologies into the marketplace? How is DOE coordinating its existing deployment programs with its technology development efforts?

D) OFFICE OF FOSSIL ENERGY

BACKGROUND:

Table 4. Fiscal Year 2005 and Fiscal Year 2006 Funding for Office Fossil Energy R&D Programs

	FY05 appropriation (in millions)	FY06 Request (in millions)	$ Change from FY05 Level	Percentage Change from FY05 Level
Fossil Energy R&D	**$572**	**$491**	**$(80)**	**-14%**
Coal programs	$287	$300	$13	5%
Fuel Cells	$78	$65	$(13)	-17%
Oil and Gas programs	$79	$20	$(59)	-75%
Other(including Program Direction)	$128	$106	$(22)	-17%
(advance approp for FY07 of $257)				
Clean Coal Account				
Net Appropriation	**-160**	**0**	**$160**	**-100%**
Advance Appropriation	97	257		
Deferral	-257	0		
Rescission	0	-257		

Budget Highlights: The Office of Fossil Energy has two accounts that fund research, development and demonstration activities: the Fossil Energy Research and Development account, and the Clean Coal Technology account. Clean coal demonstration projects in the R&D account are limited to $68 million, essentially equal to last year's funding. The budget includes $18 million to continue design of a coal power plant with carbon dioxide exhaust capture and sequestration known as FutureGen.

The Clean Coal Technology account had large appropriations in the 1990s which were then allocated to specific projects. Several of these projects were not undertaken or canceled, and large balances remain in the account. The appropriators deferred (forward-funded) $257 million of this funding to FY06. The budget proposes to defer the funding again (to FY07), and to transfer the uncommitted funding to the Fossil Energy account to cover part of the $650 million proposed federal share of the FutureGen project.

ISSUES:

What would the impact be of the proposed elimination of the oil and gas research programs? Over the last several years, the Department has consistently requested cuts to the oil and gas research programs. Evaluations of these programs by the Office of Management and Budget have consistently rated them "ineffective." H.R. 6, passed by the House of Representatives on April 21, 2005, funds an ultra-deepwater and unconventional oil and gas R&D program, using mandatory spending.

Does the proposal in the budget propose to move FutureGen from the Clean Coal program into Fossil Energy have policy implications? DOE would provide funding for the FutureGen demonstration project to build a new coal gasification power plant that would include the sequestration of carbon dioxide and potentially the production of hydrogen. Gasification turns the coal into a synthetic gas that can be burned in a turbine like natural gas, or used as a chemical feedstock. (The Clean Coal program has funded at least three previous coal gasification power plants, and gasification is commonly used in petroleum refining.) The proposed transfer of Clean Coal funds to the Fossil Energy R&D account would reduce the restrictions that help prevent cost-overruns in large demonstration projects.

Does the proposed budget for FutureGen follow the requirements in law that demonstration projects be cost shared with industry on a fifty-fifty basis? The FY06 request details the funding for this project, and shows that $620 million of the $950 million cost of the project (over 65 percent) would come from

the Federal Government. The *Energy Policy Act of 1992* requires that demonstration programs receive no more than 50 percent of their funding from federal sources.

What are the advantages and disadvantages to the management structure proposed for FutureGen? The current plan for FutureGen would have a consortium act as the intermediary between the Department and the organization that will own and operate the FutureGen project. This approach appears to be a departure from the Department's usual approach of signing a cooperative agreement with the project performer.

Why does DOE propose to cut funding for stationary fuel cells? Many analysts view the stationary fuel cell programs funded by Fossil Energy as an important stepping-stone to low-cost transportation fuel cells that are at the heart of the transition to a hydrogen economy. While fuel cell funding is up in the transportation programs of EERE, stationary fuel cell funding in Fossil is cut by 12 percent.

E) OFFICE OF NUCLEAR ENERGY, SCIENCE AND TECHNOLOGY

BACKGROUND:

Table 5. Fiscal Year 2005 and Fiscal Year 2006 Funding for Office of Nuclear Energy, Science and Technology.

Account	FY05 appropriation (in millions)	FY06 Request (in millions)	$ Change from FY05 Level	Percent Change from FY05
Total NE	$375	$390	+$15	+4.0%
Nuclear energy R&D*	$171	$191	+$20	+12.0%
- Hydrogen Initiative	*$9*	*$20*	*+$11*	*+124%*
- NERI	*$2.5*	*0*	*-$2.5*	*-100%*
- NEPO	*$2.5*	*0*	*-$2.5*	*-100%*
University Reactor Infrastructure and Education Assistance	$24	$24	$0	0%
Other NE**	$180	$175	-5.0	-3%

* Also includes Nuclear Power 2010, Generation IV Nuclear Energy Systems, and the Advanced Fuel Cycle Initiative.
**Includes civilian infrastructure management such as the Idaho Facilities Management and the Idaho Safeguards and Security.

Budget Highlights: The Department's budget proposes to eliminate the Nuclear Energy Research Initiative (NERI), which funds university researchers, and the Nuclear Energy Plant Optimization (NEPO) program, which is targeted toward boosting output from existing nuclear plants. The Department has proposed that funds for NEPO be allocated to other Nuclear R&D programs and the NERI be integrated into the Department's nuclear energy R&D programs. It is unclear whether this merger will allow NERI'S focus on fundamental research questions to continue.

ISSUES:

How will the reorganization of the Idaho laboratory complex affect DOE's overall nuclear energy R&D program? In 2003, DOE proposed to revamp the contracts of Idaho National Environmental and Engineering Laboratory and the co-located Argonne West National Laboratory, and merge them into one research unit as the lead nuclear energy laboratory for the country. What role will other national laboratories with significant nuclear expertise, such as Argonne National Laboratory, play in nuclear energy R&D after Idaho National Laboratory begins operations?

What are the advantages and disadvantages to the management structure proposed for Next Generation Nuclear Plant? The current plan for NGNP would have a consortium act as the intermediary between the Department and the organization that will own and operate the project. This approach appears to be a departure from the Department's usual approach of signing a cooperative agreement with the project performer. One immediate question posed by this proposed arrangement is: what is the liability of the Federal Government in the event that the private-sector partners walk away from the project before the demonstration is completed?

Does the Nuclear Energy R&D program intend to stimulate the revitalization of a domestic nuclear energy industry? The domestic nuclear industry has shrunk considerably since the last nuclear power plant was ordered in the 1970s. Will the U.S. industry be willing and able to participate under proposed plans?

F) OFFICE OF ELECTRICITY DELIVERY AND ENERGY RELIABILITY

BACKGROUND:

Table 6. Fiscal Year 2005 and Fiscal Year 2006 Funding for Office of Electricity Delivery and Energy Reliability

Account	FY05 appropriation (in millions)	FY06 Request (in millions)	$ Change from FY05 Level	Percent Change from FY05
Electric Transmission and Distribution				
Research and development				
High temperature superconductivity R&D	$55	$45	-$10	-18%
Transmission reliability R&D	$16	$9	-$6	-41%
Electricity distribution transformation R&D	$5	$4	-$1	-25%
Energy storage R&D	$4	$3	-$1	-24%
Gridwise	$6	$6	-$1	-15%
Gridworks	$5	$5	$0	-8%
Total, Research and development	**$91**	**$72**	**-$20**	**-22%**
Electricity restructuring	$20	$12	-$7	-38%
Program direction	$8	$11	$3	41%
Construction	$1	$0	-$1	-100%
Total, Electric Transmission and Distribution	**$120**	**$96**	**-$25**	**-20%**

Budget Highlights: Two new initiatives from FY04, GridWise and GridWorks, were cut by a total of $1.3 million (-12 percent). These programs are focused on developing communications and control technologies along with advanced cables, switches, and monitors to improve the transmission and distribution of electricity.

ISSUES:

What will cuts to energy storage R&D imply for other DOE programs? Energy Storage programs resided in EERE prior to the creation of the Office of Electric Transmission and Distribution and its subsequent reorganization into the Office of Electricity Delivery and Energy Reliability. The storage of energy is an important tool for improving the stability and reliability of the grid, and is vital to emerging energy resources such as wind and solar-generated electricity. Such sources can only generate power intermittently (when the wind is blowing, for example), and they would be much more attractive if the energy they generate could be stored for later use. Funding for Energy Storage R&D in FY04 was $8.8 million, but has been cut considerably. In FY06, the request for Energy Storage again received a large cut $1 million (-25 percent) to $3 million, following on last year's cut of $4.8 million, (-55 percent) to $4 million.

How is the work of the Office of Electricity and Energy Assurance coordinated with the other applied energy offices? The work of the R&D programs in electricity transmission and distribution is important for the successful integration of the energy resources being developed in the applied energy R&D offices. Does the Office undertake any joint research efforts? How are the results of the R&D transmitted to the other offices?

5. Witnesses Questions

Witnesses have been asked to summarize the budget request for their offices focusing on activities identified as part of the Federal Science and Technology (FS&T) budget and specifically address the following issues:

Questions for Dr. Orbach

Given the reduced funding outlook for Office of Science, do you plan to revise your 20-Year Facilities Plan? How will you make the choices between building new and running existing facilities, and between facilities and funding for research grants?

Will the Department be able to simultaneously support three facilities for nuclear physics—the Relativistic Heavy Ion Collider, the Continuous Electron Beam Accelerator Facility and the Rare Isotope Accelerator? If not, when and how will the Department make a decision about the future of its nuclear physics facilities?

Given limited funds, many in the fusion research community have indicated that the U.S. should drop its participation in ITER if it would require deep cuts in funding for the domestic program. Do you agree? If we do go ahead with ITER, how would you continue to support a domestic program and what would it look like?

Does the Department intend to support a high energy physics (HEP) facility in the U.S. after 2010? Would that be necessary given U.S. participation in HEP experiments at the European Large Hadron Collider (LHC)?

Questions for Mr. Faulkner

How does your Office determine the proper balance between shorter-term and longer-term projects in its portfolio?

What steps is the Department taking to ensure that technologies for shorter-term gains in energy efficiency and alternative sources make the transition into the marketplace?

Both the National Academy of Sciences and the American Physical Society have noted that more R&D will be needed in alternative energy sources to help enable a hydrogen economy. How does the budget for renewable energy R&D address this need?

Questions for Mr. Maddox

Using the definitions in Office of Management and Budget Circular A–11, what is the proposed mix of funding in the fiscal year 2006 budget request between basic research, applied research, development, demonstration, and deployment activities for your Office? Please provide the comparable fiscal year 2005 numbers.

What is the rationale for eliminating the oil and gas technology research and development programs at the Department?

Questions for Mr. Johnson

Why are the Nuclear Energy Research Initiative and the Nuclear Energy Plant Optimization programs being eliminated?

What role will other National Laboratories with significant nuclear expertise, such as Argonne National Laboratory, play in nuclear energy R&D after Idaho National Laboratory begins operations?

Please explain the ownership and management structure the Department is proposing for the Next Generation Nuclear Plant. What advantages and disadvantages does this approach have? What happens if the industrial partners fail to fulfill their obligations?

Questions for Mr. Kolevar

How does your Office determine the proper balance between shorter-term and longer-term projects in its portfolio?

What is the rationale for the proposed reduction in the fiscal year 2006 budget for energy storage, given its likely contribution to improving grid stability and enabling the connecting of intermittent sources (such as wind) to the grid?

What is the rationale for cuts to Gridwise and Gridworks, given that these programs were just created last year? What impacts will these cuts have on the ability of these programs to help modernize the electric grid and turn prototype technologies into useful and widely used technologies for the grid? What is the proper role for the industry in these research efforts?

Chairwoman BIGGERT. The Subcommittee will come to order.

First, I would like to welcome everyone to the first Energy Subcommittee hearing of the 109th Congress. I would like to welcome our new Ranking Member, Mr. Honda. And I would also like to welcome our witnesses, Dr. Raymond Orbach, Director of the Office of Science, Mr. Douglas Faulkner, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, and Mr. Mark Maddox, Principal Deputy Assistant Secretary for Fossil Energy, and Mr. Robert Shane Johnson, Director for Technology, the Office of Nuclear Energy, Science, and Technology, and Mr. Kevin Kolevar, Director for the Office of Electricity Delivery and Energy Reliability.

As our witnesses should know, spoken testimony is limited to five minutes each, after which the Members of the Energy Subcommittee will have five minutes each to answer questions. So hold that, because we have a few things to do first.

And I apologize for starting late. We have to have a quorum before we can start, and we are going to, unfortunately, have to recess shortly because of a vote that will be coming up and a photograph on the House Floor.

So I will recognize myself for five minutes for an opening statement.

And I want to welcome everyone to this Energy Subcommittee hearing on the Administration's priorities for research and development in the Department of Energy Budget for fiscal year 2006.

It is no secret that we are operating in the most constrained budget environment in many years. Such an environment is especially important for Congress to scrutinize the plans and question the priorities of any and all departments when it comes to spending limited resources. The Department of Energy is no exception. I am as fiscally conservative as they come, and while I agree that we should be able to find savings in just about every corner of the federal budget, I do not believe that we should be cutting corners when it comes to our search for energy solutions and the science behind them.

As the Nation struggles—as the Nation pays unprecedented prices for oil and natural gas, it struggles to contain the resulting inflationary pressure. It seems counterintuitive to reduce funding for applied energy research and development programs that could help ease our demand for energy or lead to alternative sources of it, namely our energy efficiency and renewable energy programs.

The same can be said for the basic science programs funded by the Department of Energy. As the Nation emerges from an economic slowdown and confronts global competition on a variety of fronts, it also seems counterintuitive to cut, by almost four percent, the basic, fundamental research that is the foundation of American innovation and creativity and competitiveness.

But in some specific ways, this is what the Administration's budget proposes to do. Based on an analysis by Subcommittee staff, funding for every applied energy R&D program has increased over the course of the last five years, some substantially. However, this is misleading when it comes to one program in particular. When you exclude the significant increases provided for the President's hydrogen and FreedomCAR initiatives, the Energy Efficiency and

Renewable Energy, EERE, program, actually has suffered a percentage decline in the double digits over the course of the last five years.

Don't get me wrong. I strongly support the hydrogen and FreedomCAR initiatives, but are we sacrificing short and mid-term successes in many sectors for the sake of one long shot in one sector, transportation over the long-term. If so, this is a wise choice, especially considering that a National Academy of Sciences study estimates that for every dollar spent on efficiency initiatives alone between 1978 and 2000, more than $4 of economic benefits were realized? We will explore this more today.

At this point, I have become accustomed to lamenting proposed reductions to the nuclear energy R&D program. That is not the case this year. I am particularly pleased with the proposed funding levels for the Advanced Fuel Cycle Initiative.

As costs mount over the Federal Government's failure to complete Yucca Mountain, I think it is time that we revisit the issue of using advanced reactors to recycle some of the spent nuclear fuel scattered across this country. This is even more critical if a plan to encourage the construction of new plants succeeds. That plan, which President Bush is expected to outline later today, would provide federal risk insurance to companies that construct new nuclear power plants.

As for the other basic research supported by the DOE, this subcommittee has noticed a trend. Three years ago, Office of Science funding for facilities equaled that for research grants. Today, funding for research grants is less than for facilities. Considering that DOE's user facilities are over-subscribed by a factor of three in the case of basic energy sciences programs within the Office of Science, this may have been a prudent decision in light of fiscal constraints. However, I do not believe this is sustainable, especially considering that DOE's research grants help fund the education and training of approximately 23,500 graduate students, technicians, postdocs, and faculty.

Finally, when it comes to new facilities, I am very concerned about the significant amount of our limited resources that this budget has allocated to the international fusion experiment, known as ITER, which doesn't even have a home yet. And considering that the patience of this committee is growing thin as we continue to wait for the DOE to respond to our written questions from a Full Committee hearing on the President's budget held over two months ago, I must again express skepticism and concern about the moving target that is the U.S. contribution to the ITER project. I certainly hope this is something we can nail down and soon. I would hate for this lingering question to erode support for this project.

On that note, I will conclude by saying that I am looking forward to hearing the testimony of the witnesses here today. We are going to discuss programs that matter a great deal to our nation's energy security and our economic future. During these tight fiscal times, we must set priorities and use limited resources wisely. We are here today to make sure the proposed fiscal year 2006 budget meets these standards.

Thank you.

And at this time, I would recognize our Ranking Member of this subcommittee, Mr. Honda, for his opening statement.

Mr. HONDA. Thank you, Chairwoman Biggert, and thank you for holding this important hearing today, my first as a Ranking Member of this subcommittee. And I regret that I will not be able to be here in its entirety, and I apologize to all of you in advance.

I also extend my thanks to the distinguished panel of witnesses for taking the time to be here today to tell us in greater detail about the budgets of your respective programs.

It probably comes as no surprise to anyone that I am disappointed by the five-percent decline in the Department of Energy's non-defense R&D budget. I expect to hear talk about times of tight budgets and the need to make tough choices, but I continue to believe that we do not really need to be in this budget situation, rather that it was created by tax cuts for the wealthiest of Americans here.

What troubles me the most is that these R&D funding cuts are coming at a time when other nations are increasing their investments in basic scientific research and development and as well as commercializing technology. When other nations are posing a greater challenge than ever to U.S. competitiveness in the global marketplace, we are making it easier for them to catch up and even surpass us rather than investing in what made the United States great.

The President's own Council of Advisors on Science and Technology, PCAST, has decried prior under-funding of physical sciences and the DOE Office of Science, in particular. Without additional funds, our national labs will be forced to continue to defer maintenance and deteriorate. Our best and brightest students will choose not to pursue careers in math, science, and engineering and innovation at our companies will suffer.

I am fortunate to come from the San Francisco Bay Area and to have had many opportunities to visit Department of Energy facilities, the Stanford Linear Accelerator Center, Lawrence Berkeley National Lab, and the Lawrence Livermore National Lab. And during those visits, as well as at hearings in this room, I have learned about the critical role DOE plays in advancing U.S. science.

I have learned, as you all know, that DOE is the leading source of federal funds and facilities for research in the physical sciences, providing 42 percent of the federal investment in these disciplines. In subfields such as high-energy and nuclear physics, nuclear medicine, heavy-element chemistry, plasma physics, and the magnetic fusion and catalysis, DOE is the primary government sponsor.

I have learned that DOE's significant investment in major user facilities located at the universities and National Laboratories sets it apart from other agencies. More than 19,000 researchers use DOE's scientific facilities every year, nearly half of who are university faculty members and students. Were it not for DOE, these vital scientific facilities would not exist in the United States.

I appreciate the efforts you put forth, Dr. Orbach, to maintain funding levels for these facilities within the fiscal year 2006 budget request. Unfortunately, as you have explained, these funding levels come at the cost of cuts to support for investigators and their re-

search projects, which means the facilities will not be used to their full potential.

I applaud the work you have done with the scientific community to develop plans on how you would spend additional funds responsibly. Your Office of Science Strategic Plan and Twenty Year Outlook on Facilities for the Future of Science provide a clear rationale for why additional funding for DOE science is warranted and a road map on how these funds should be spent.

Unfortunately, we are only in the first budget cycle covered by these plans, and already funding levels are insufficient to address the needs identified in them. This is an inauspicious beginning.

I am also perplexed by cuts to the Energy Efficiency R&D and Renewable Energy R&D programs. Just the other day, as the House passed an energy bill that provided incentives to explore for more oil and gas, President Bush said "with $55 oil we don't need incentives to oil and gas companies to explore—what we need is to put a strategy in place that will help this country over time become less dependent."

It seems to me that the best way to achieve this laudable goal is to become less dependent on oil and gas, is to use less energy, and to develop other sources of energy. And yet the fiscal year 2006 DOE budget cuts research in these critical areas, in such fields as Building Technologies, which is at minus 12 percent, Industrial Technologies, which is at minus 25 percent, and the Biomass program, which is at minus 18 percent.

But we can not afford to wait until the need grows even greater and then suddenly ramp up our investment, because that will not work. Research takes both money and time, so we must keep investing steadily to make the progress that is needed. And if we fail to invest in renewable energy and energy efficiency now, talented scientists and engineers will apply their skills elsewhere and will not be available when the need becomes even more pressing.

There are many questions that must be answered about this budget request and the direction in which DOE is headed in the future. I hope the witnesses will provide us with those answers.

Thank you, Madame Chair, and I yield back the balance of my time.

[The prepared statement of Mr. Honda follows:]

PREPARED STATEMENT OF REPRESENTATIVE MICHAEL M. HONDA

Chairwoman Biggert, thank you for holding this important hearing today, my first as the Ranking Member of this subcommittee. I regret that I will not be able to be here for the entire hearing, and I apologize to the witnesses in advance for having to leave.

I also extend my thanks to the distinguished panel of witnesses for taking the time to be here today to tell us in greater detail about the budgets of your respective programs.

It probably comes as no surprise to anyone that I am disappointed by the five percent decline in the Department of Energy's Non-Defense R&D budget. I expect to hear talk about "times of tight budgets" and the need to make tough choices, but I continue to believe that we do not really need to be in this budget situation, rather that it was created by tax cuts for the wealthiest Americans.

What troubles me the most is that these R&D funding cuts are coming at a time when other nations are increasing their investments in basic scientific research and development, as well as in commercializing technology. When other nations are posing a greater challenge than ever to US competitiveness in the global marketplace, we are making it easier for them to catch up and even surpass us, rather than investing in what made the United States great.

The President's own Council of Advisors on Science and Technology has decried prior under-funding of physical sciences, and the DOE Office of Science in particular. Without additional funds, our national labs will be forced to continue to defer maintenance and deteriorate; our best and brightest students will choose not to pursue careers in math, science, and engineering; and innovation at our companies will suffer.

I am fortunate to come from the San Francisco Bay Area and to have had many opportunities to visit Department of Energy facilities—the Stanford Linear Accelerator Center, Lawrence Berkeley National Lab, and Lawrence Livermore National Lab. During those visits, as well as at hearings in this room, I have learned about the critical role DOE plays in advancing U.S. science.

I have learned, as you all know, that DOE is the leading source of federal funds and facilities for research in the physical sciences, providing 42 percent of the federal investment in these disciplines. In subfields such as high-energy and nuclear physics, nuclear medicine, heavy-element chemistry, plasma physics and magnetic fusion and catalysis, DOE is the primary government sponsor.

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We cannot afford to wait until the need grows even greater and then suddenly ramp up our investment, because that will not work. Research takes both money and time, so we must keep investing steadily to make the progress that is needed. And if we fail to invest in renewable energy and energy efficiency now, talented scientists and engineers will apply their skills elsewhere and will not be available when the need becomes even more pressing.

There are many questions that must be answered about this budget request and the direction in which DOE is headed in the future, and I hope the witnesses will provide us with those answers.

Chairwoman BIGGERT. Thank you, Mr. Honda.

[The prepared statement of Ms. Woolsey follows:]

PREPARED STATEMENT OF REPRESENTATIVE LYNN WOOLSEY

Thank you, Madame Chairman.

I am pleased to be here today, because this hearing is an important one. We need real energy independence in the *United States.* But energy independence will only come about when we start focusing our efforts on clean, renewable sources of energy.

In considering the *Fiscal Year 2006 Budget,* I hope that the *Department of Energy* is focused on the important goal of energy independence. More than ever before,

America's energy requirements have become an issue of national security. Nothing hurts our security as much as our dependence on *Middle East* oil.

We need to pursue clean, environmentally friendly, renewable sources of energy. This is the best and only way to ensure both America's energy independence while also preserving the environment for future generations.

In the process, we must not focus our efforts on stop-gap measures like oil drilling in the *Arctic National Wildlife Refuge.* Drilling in *Alaska* will do little to reduce our current dependence on foreign oil, because it will take more than *ten* years to process what little oil may be there.

If we spend half the time promoting policies that encourage the use of renewable energy that we do discussing drilling in *ANWR,* we can develop a sensible *energy policy* that ensures real energy independence. I hope the *DOE Budget* for *Fiscal Year 2006* takes this into consideration.

I yield back.

[The prepared statement of Mr. Davis follows:]

PREPARED STATEMENT OF REPRESENTATIVE LINCOLN DAVIS

Good morning. I appreciate the opportunity to have this hearing and the witnesses who are here today.

The activities of the Oak Ridge National Laboratory, near my District, are being hurt by budget cuts. It is my hope that today's hearing will underscore the fact that if we do not finish what we started in planning for and supporting these programs, our nation's computing, energy, and life science research programs will suffer.

Last May, DOE Secretary Abraham announced that Oak Ridge was the winner of a DOE competition to establish a leadership-class computing facility. Secretary Abraham stated that the U.S. must "make the commitment necessary to regain the clear-cut lead" in supercomputing.

Last year, the President signed the *DOE High-End Computing Revitalization Act of 2004,* drafted in the House Science Committee, in November 2004. And yesterday afternoon, the House approved H.R. 28, a bill to strengthen agency efforts to support the supercomputing enterprise.

With all this momentum, I was surprised by the President's FY06 request for high-end computing. The Center for Computational Sciences at Oak Ridge, home to the leadership computing facility Secretary Abraham commended, received only $25 million in the budget—a figure well below FY05 and even FY04 levels.

That money is not enough to even operate the two supercomputing machines being purchased in FY05, and it does not allow any hardware upgrades to those computers. DOE does not appear to be fulfilling the vision articulated by Secretary Abraham just a year ago, which was to regain the lead in high-end computing.

A second issue that I have deals with the DOE's Genomics "Genomes to Life" program. I understand that DOE is currently planning a set of four core research facilities. The scope and scale of the four facilities is impressive, and the cost estimates for each run to approximately $250 million. I do not understand why DOE is planning big budgets for start-up initiatives when it is not providing needed funding for its current programs.

Due to time constraints, I ask that the questions I have today be submitted for the Record. I hope that the Department of Energy will respond to these questions to me in writing.

In summary, I feel that it is unfair and unjustified for Oak Ridge and other DOE national labs to go through the planning process, set goals, be promised the funding, and have the rug pulled out from underneath them. I hope that the Department of Energy will rethink its budget policies. The Oak Ridge supercomputing facility is an economic jewel to Tennessee and to our nation. I hope that the proposed budget cuts do not tarnish that jewel.

Supercomputing Questions:

1) Does DOE intend in FY 2007 to resume hardware acquisition to actually establish a true leadership class computing facility?
2) What are the Department's long-term plans for the leadership facility awarded last year to the team led by Oak Ridge National Lab?
3) How does contribute to establishment of a leadership class computer?
4) How does the Department justify the newly proposed "Research and Evaluation Prototypes," funded at $13.2 million, a "new start" in FY06 when the budget also includes a significant cut to the Center for Computational Sciences, an established program?

Genomes to Life/Priorities Question:

Given the constrained budgets faced by DOE in the coming fiscal years, which already are constraining operation of existing user facilities, will DOE reconsider the scale and scope of these four GTL start-up facilities, so that the cost of each is reduced?

[The prepared statement of Mr. Costello follows:]

PREPARED STATEMENT OF REPRESENTATIVE JERRY F. COSTELLO

Good morning. I want to thank the witnesses for appearing before our committee to discuss the Department of Energy's FY 2006 budget request. Today's hearing serves as an opportunity to review the proposed research and development budgets and to clarify the President's energy-related science and technology priorities.

The Department of Energy's Fossil Energy Research and Development program impacts my congressional district because the coal industry is of great importance to the economy and livelihood of my constituents in Southern Illinois. My home state has almost one-eighth the coal reserves in the United States and the largest reserves of bituminous coal in the Nation. We have long supported the coal industry through programs that finance research, development, and commercialization of new technologies and uses of coal. As a result, I am proud to say that Illinois is a national leader in developing clean and efficient coal technologies.

The Administration's budget for FutureGen and the base coal R&D programs appears to be one of the best budget requests in recent years. I would like to express my support for protecting the base coal R&D and welcomed the inclusion of $18 million for the FutureGen clean coal power plant project for FY06. Further developing the technology to burn coal as cleanly as possible is a great national investment and it will benefit the economy of Southern Illinois. I have led the effort to locate FutureGen in Illinois, including leading a bipartisan effort in the House to secure funding for the project. I also hosted a roundtable discussion regarding FutureGen and what it means for Illinois and was pleased to have Mr. Mark Maddox in attendance. This year, I initiated a bipartisan letter to the House Energy and Water Development Subcommittee to express congressional support for the Administration's FY06 fossil energy coal programs. We are asking that coal research and demonstration programs be funded at or above a higher level in order to achieve the intended goals that support the FutureGen vision of coal fueled generation of electricity and hydrogen with essentially zero emissions. I will continue to be a strong advocate for implementing the coal research programs, which includes the clean coal technology program and the FutureGen project because they are significant to my District. I am committed to working with my colleagues, the Administration, and industry to ensure the project continues to move forward as planned and will continue to advocate its site location in Southern Illinois.

I welcome our panel of witnesses and look forward to their testimony.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF REPRESENTATIVE EDDIE BERNICE JOHNSON

Thank you, Madam Chairman. I greatly appreciate you calling this hearing and I am especially grateful that our distinguished witnesses have agreed to take time out of their busy schedules to answer our questions today.

The purpose of this hearing is to provide an opportunity to explore issues affecting the entire Research and Development (R&D) budget.

As I said at the Research and Development budget hearing we had in February, I have a lot to say today about the budget we have before us. The budget includes severe cuts to almost every major government program and creates a deficit in 2006 that is likely to top $400 billion. This budget can be categorized as reckless and irresponsible.

Programs to promote efficiency and renewable energy would be reduced to about $1.2 billion or four percent. Double-digit cuts to many programs in this category were hidden by a 16 percent increase to $260 million for a program to develop hydrogen as an efficient fuel source.

The reductions prompted critics to question the White House's energy priorities. In addition, this plan would reduce the Department's extensive science and technology programs by about four percent, or 3.5 billion, while environmental cleanup activities would be reduced by eight percent, to $6.5 billion.

What really disturbs me about the Department of Energy's budget is that it assumes $2.4 billion revenue in oil and gas leasing at the Arctic National Wildlife Ref-

uge, even though Congress has never approved a plan opening this land for oil exploration.

Members of Congress must be fiscally responsible when it comes to making decisions about our budget during these trying times. Our greatest responsibility is to leave our children a world that is safer, more prosperous, and more secure.

This budget fails that test. It is fiscally irresponsible. It is morally irresponsible. And it demonstrates a failure to lead.

[The prepared statement of Mr. Green follows:]

PREPARED STATEMENT OF REPRESENTATIVE AL GREEN

First and foremost, I'd like to thank Chairwoman Biggert and Mr. Honda for initiating a hearing regarding the FY06 budget request for the Department of Energy's civilian research and development programs. As a freshman Member, I am particularly intrigued by the activities and roles that research and development play as we move forward in attempting to provide a comprehensive energy strategy. It is my understanding that a lot of our energy strategy framework is based upon research and development initiatives of this department, so I take particular pride in having the opportunity to discuss these valuable programs and priorities with the people that are directly shaping the focus of our energy policy. I find that both my constituents and I are concerned with an array of energy issues, and I also relish the opportunity to find out answers for them. In addition to the focus on energy with the discussion of the energy bill, there has been a heightened awareness of our energy infrastructure because of the Northeastern energy grid black in 2003, skyrocketing gas prices, and revolving blackouts in California about four years ago. A major concern that I have is that the proposed budget seems to de-emphasize the necessity for energy efficiency and renewable energy by continuing to reduce funding for energy efficiency and renewable energy R&D, with the exception of activities supporting the Administration's hydrogen initiatives so I hope that we touch on such a discussion. Again, I'd like to reiterate my thanks to all of the panelists for their willingness to share their particular insights on the various research and development initiatives proposed in the FY06 budget, and I hope that the Science Committee will continue to have a strong relationship with the Department of Energy research and development sectors in the future.

Chairwoman BIGGERT. I think that we will begin until the bells go off when we have to have to recess.

But let us start with Dr. Orbach. I wish more Members were here right now, but I am sure they read all of the 20 pages of your testimony and know it word for word.

Please proceed for five minutes.

STATEMENT OF DR. RAYMOND L. ORBACH, DIRECTOR OF THE OFFICE OF SCIENCE, DEPARTMENT OF ENERGY, WASHINGTON, DC

Dr. ORBACH. Thank you, Chairman Biggert and Ranking Member Honda. Thank you both for your opening remarks. They were very helpful and I am very grateful for your interest and commitment for science and for the country.

This is an opportunity for me to discuss with you the fiscal year 2006 budget for the Office of Science. And as you both noted, scientific leadership for the United States is critical for our economy, for our scientific literacy, for the excitement of discovery, and for education in order to attract the very best to science careers.

I made the decisions for this budget on that basis, namely how would we use the funds available to us in this budget climate to maintain scientific leadership for the future. The results were difficult in many cases, but I believe that what we have presented to you is a budget that will maintain U.S. leadership for the future.

We will be beginning in fiscal year 2006 major operations of our facilities. Chairman Biggert has already discussed ITER, which has

its first contribution for construction contained in our 2006 budget. We also will be putting two 20-teraflop computers, the largest machines available to the civilian world, on the floor in 2006 at Oak Ridge National Laboratory, and shortly, we will be announcing a national competition for opportunities on these machines for scientific discovery. We will be starting the Spallation Neutron Source at Oak Ridge National Laboratory, which is, by an order of magnitude, the most intense neutron source in the world for spallation neutrons. It will give our scientists an edge over everyone else, not just for structure, but also for dynamics.

We are beginning the operation of four of our five nanocenters. Everyone is investing in nanotechnology, but what will set the United States apart will be these nanocenters, which will have within them all of the facilities that our scientists will need for construction and for structure of these materials as they are being grown, and in addition, because they are next to light sources and the Spallation Neutron Source, the dynamics of these materials as well.

Finally, we will be beginning construction of the Linac Coherent Light Source at Stanford Linear Accelerator. This will be the brightest x-ray source in the world by 10 billion times in the hard x-ray range. That is a range where crystal structures for biological materials are important. More importantly, it is so bright that we will be able to do the structure of a single macromolecule. About half of the proteins that we would like to determine structures of do not crystallize, and so we can not use conventional light sources for their structure. But we will be able to measure one molecule at a time so that we can look at cell wall structures, for example, for the first time.

In addition, this light source is a very fast source. Its timing is of the order of less than a femtosecond, that is 10^{-15} seconds. It is so fast that we will be able to see the formation of the chemical bond as a chemical reaction is taking place. This will mean that we will be opening up a whole new field of science, namely ultrafast science.

I have just given you a snapshot of where we are making our investments so that our scientists will have opportunities that nobody else will have. In this budget climate, it comes at a cost, and both of you have outlined that cost. And it was a choice that we had to make between the future. And we made those choices with—difficult choices. We think they are in the interest of the country.

Most of you are ardent supporters of the Office of Science, and we are very grateful for that. We believe this budget will maintain U.S. scientific leadership for the future, and we thank you very much for your support.

[The prepared statement of Dr. Orbach follows:]

PREPARED STATEMENT OF RAYMOND L. ORBACH

Chairman Biggert and Members of the Subcommittee:

Thank you for the opportunity to testify today about the Office of Science's Fiscal Year (FY) 2006 budget request. I am deeply appreciative of your support for basic research, Madame Chairman, and the support we have received from the other Members of this subcommittee. I am confident that our FY 2006 request represents

a sound investment in our nation's future. Through this budget we will position the Office of Science to be ready for the opportunities of the next decade.

This budget, Madame Chairman, will enable thousands of researchers located across our nation to work on some of the most pressing scientific challenges of our age. These researchers will demonstrate the scientific and technological feasibility of creating and controlling a sustained burning plasma to generate energy through participation in ITER (Latin for *the way,* ITER is an international fusion collaboration); use advanced computation and modeling tools to resolve complex scientific problems; restore U.S. leadership in neutron science with the start of operations at the Spallation Neutron Source (SNS); expand the frontier of nanotechnology through operation of Nanoscale Science Research Centers (NSRCs); pursue an understanding of how the universe began; contribute to our understanding of climate change including the potential of carbon sequestration; develop the knowledge that may enable us to harness microbes and microbial communities to improve energy production and environmental remediation; and contribute basic research that underpins the President's Hydrogen Fuel Initiative.

The Office of Science requests $3,462,718,000 for the FY 2006 Science appropriation, a decrease of $136,828,000 from the FY 2005 appropriation, for investments in basic research that are critical to the success of Department of Energy (DOE) missions in national security and energy security; advancement of the frontiers of knowledge in the physical sciences and areas of biological, environmental, and computational sciences; and provision of world-class research facilities for the Nation's science enterprise (see Figure 1).

The Office of Science, within a period of budget stringency, has chosen its priorities so that the U.S. will continue its world primacy in science. We have made the hard decisions that will enable our scientists to work on the finest machines whose scale and magnitude will give them opportunities not found elsewhere. As a consequence, we have made difficult choices. But these have been taken with one end in mind: the Office of Science will support a world-class program in science and energy security research with this budget.

This budget request supports the following programs: Basic Energy Sciences, Advanced Scientific Computing Research, Biological and Environmental Research, High Energy Physics, Nuclear Physics, Fusion Energy Sciences, Science Laboratories Infrastructure, Science Program Direction, Workforce Development for Teachers and Scientists, and Safeguards and Security.

The Office of Science supports research across the scientific spectrum from high energy physics to biology and environmental research; from fusion energy sciences to nuclear physics, from basic energy sciences to advanced scientific computation research. We provide 42 percent of the federal funding for the physical sciences in the United States, and are the stewards of support for fields such as high energy physics, plasma physics, catalysis, and nuclear physics. We build and operate the large scientific facilities used by over 19,000 faculty, students, and postdocs each year. They include synchrotron light sources, neutron sources, high energy and nuclear physics accelerators, fusion energy experiments, dedicated scientific computing resources, specialized environmental research capabilities, the Production Genome Facility, and will soon include the SNS, five NSRCs, and an X-ray free electron laser light source. Roughly half of our budget goes to the construction and operation of these facilities; the other half is split, roughly equally, between research at the DOE laboratories and research at universities. This supports the research of approximately 23,500 students, postdocs, and faculty throughout our nation.

OFFICE OF SCIENCE

FY 2006 PRESIDENT'S REQUEST

(B/A in thousands)

	FY 2004 Comparable Approp.	FY 2005 Comparable Approp.	FY 2006 President's Request
Basic Energy Sciences	991,262	1,104,632	1,146,017
Advanced Scientific Computing Research	196,795	232,468	207,055
Biological and Environmental Research	624,048	581,912	455,688
(Congressionally-directed projects)	*(136,798)*	*(79,608)*	*(——)*
(Core Biological and Environmental Research)	*(487,250)*	*(502,304)*	*(455,688)*
High Energy Physics	716,170	736,444	713,933
Nuclear Physics	379,792	404,778	370,741
Fusion Energy Sciences	255,859	273,903	290,550
Science Laboratories Infrastructure	55,266	41,998	40,105
Science Program Direction	150,277	153,706	162,725
Workforce Development for Teachers and Scientists	6,432	7,599	7,192
Safeguards and Security	56,730	67,168	68,712
Small Business Innovation Research/Technology Transfer	114,915	——	——
Subtotal, Science	3,547,546	3,604,608	3,462,718
Use of prior year balances	-11,173	-5,062	——
Total Science	3,536,373	3,599,546	3,462,718
(Total, excluding Congressionally-directed projects)	*(3,399,575)*	*(3,519,938)*	*(3,462,718)*

Figure 1

FY 2006 SCIENCE PRIORITIES

In his testimony before the House Science Committee, the President's Science Adviser, Dr. Jack Marburger indicated, "Making choices is difficult even when budgets are generous. But tight budgets have the virtue of focusing on priorities and strengthening program management. This year's R&D budget proposal maintains levels of funding that allow America to maintain its leadership position in science and move ahead in selected priority areas."

The priorities the Office of Science has set within the overall Federal R&D effort and in support of DOE's mission are clear: Through the FY 2006 Budget, we will fully support Presidential initiatives in fusion and hydrogen; we will continue strong support for other Administration priorities such as nanotechnology and information technology; we will complete—on time and within budget—unique scientific facilities that will maintain and enhance research in areas we believe offer the greatest potential for broad advances in future energy technologies. These scientific facilities were prioritized in our 20-year facilities outlook, announced in November 2003.

We will continue moving ahead with our contributions to the President's Hydrogen Fuel Initiative. We are supporting U.S. participation in the ITER project to pursue the potential of energy from fusion.

One of the biggest science stories of the year 2006 will be the start-up of the Spallation Neutron Source at our Oak Ridge National Lab, which will provide the most intense—by an order of magnitude—neutron beam in the world for cutting-edge research.

The FY 2006 budget will also bring four of our five nanoscale science research centers on line, providing tools found nowhere else in the world for exploration at the atomic level, offering huge potential for the discovery of entirely new ways to build materials.

We are fully funding construction of the Linac Coherent Light Source at the Stanford Linear Accelerator Center, a machine that will produce x-rays 10 billion times

brighter than any existing x-ray source on Earth. When it comes on line in 2009, it essentially will allow stop-action photography of atomic motion. Just ask the pharmaceutical industry what they could do with a machine that shows them how the chemical bond forms *during* a chemical reaction.

The Office of Science also will fully fund the National Energy Research Scientific Computing Center, a key center for capacity supercomputing used by roughly 2,000 researchers every year, and a separate open-access leadership class computing facility at Oak Ridge, focused on providing the capability to carry out a limited number of massive simulations not possible on any other civilian supercomputer in the U.S.

The Department will also expand research underpinning biotechnology solutions to the world's energy challenges and research supporting the President's climate change science program.

Our research programs in high energy physics continue to receive strong support. We have increased funding for future accelerators such as the Large Hadron Collider, scheduled to begin operation in 2007, and the proposed International Linear Collider, which is now in an early R&D phase. Our nuclear physics program will continue to offer world-class facilities for use by thousands of researchers from around the world.

SCIENCE ACCOMPLISHMENTS

The Office of Science has proven its ability to deliver results over the past 50 years. That legacy includes 70 Office of Science sponsored Nobel Laureates since 1954. Our science has spawned entire new industries, including nuclear medicine technologies that save thousands of lives each year, and the nuclear power industry that now contributes 20 percent of the power to our nation's electricity grid. It has also changed the way we see the universe and ourselves; for example—by identifying the ubiquitous and mysterious "dark energy" that is accelerating the expansion of the universe and by sequencing the human genome. The Office of Science has taken the lead on new research challenges, such as bringing the power of terascale computing to scientific discovery and industrial competitiveness. The Nation's investment in SC's basic research programs continues to pay dividends to the American taxpayer. Some of the past year's highlights include:

- *Promoting Science Literacy and Fostering the Next Generation of DOE Scientists.* In FY 2004, DOE launched a seven-part program named STARS: Scientists Teaching and Reaching Students. This program is designed to enhance the training of America's mathematics and science teachers; boost student achievement in science and math, especially in the critical middle school years; and draw attention to the women and men who have done DOE science so very well—and thereby encourage young people and prospective teachers to pursue careers in math and science. STARS is a critical step in leveraging the resources of DOE—and of all our national laboratories—to help create a new generation of scientists who will achieve the scientific breakthroughs and technological advances so essential to our future security and prosperity.
- *Nobel Prize in Physics.* The 2004 Nobel Prize in physics was awarded to David J. Gross (Kavli Institute, UC Santa Barbara), H. David Politzer (Caltech), and Frank Wilczek (MIT) for their discovery of "asymptotic freedom" in the strong force. What they discovered was a surprising fact: as fundamental particles get closer to each other, the strong force between them grows weaker, and the further apart they are, the stronger it is, like stretching a rubber band. This discovery is a key component of the very successful Standard Model of particle physics, which describes three of the four fundamental forces of nature: electromagnetic, weak, and strong. Physicists dream of extending the theory to include the fourth fundamental force, gravity. The Office of Science has supported the research of Wilczek since the 1980's at Princeton and the Massachusetts Institute of Technology (MIT) and has supported Politzer at Caltech from the 1970's.
- *Nobel Prize in Physics.* The 2003 Nobel Prize for Physics was shared by Argonne National Laboratory (ANL) researcher Alexei A. Abrikosov for his pioneering contributions to the theory of superconductors. The Office of Science has long supported Abrikosov's work on the mechanisms of high temperature superconductivity. Amongst the myriad applications of superconducting materials are the magnets used for magnetic resonance imaging, or MRI, and potential applications in high efficiency electricity transmission and high-speed trains.
- *New Physics Emerges From Quark-Gluon Plasma.* In 2004, the Relativistic Heavy Ion Collider (RHIC) at the Brookhaven National Laboratory (BNL) delivered gold beams at twice the accelerator design limits and greatly exceeded

the expectations of the 1,000-plus international physicists working on the four experiments at RHIC. The goal of RHIC is to recreate the predicted quark-gluon plasma, an extremely dense state of matter thought to have last existed microseconds after the Big Bang. RHIC has announced evidence of a quark-gluon state of matter at high density and temperature, exhibiting the properties of a highly correlated liquid—something new and unexpected- as well as indications of a dense, weakly interacting gluonic matter that has been called a "Color Glass Condensate"—again something new.

- *Wide Acceptance of Open-Source, High-End Cluster Software by Industry and Users.* The Oak Ridge National Laboratory (ORNL) Open Source Cluster Application Resources (OSCAR) computing software for high-end computing continues to expand its capability and to increase its user base. The software has been downloaded by more than 130,000 groups around the world and is promoted by vendors such as Dell and Intel. The adoption of this system has expanded the number of software packages available to the cluster community, and continues to reduce cluster total cost of ownership. It has simplified the job of software authors, system administrators, and ultimately the application user by providing a timely and much simpler method of supplying and applying software updates. The Scientific Discovery through Advanced Computing (SciDAC) Scalable Systems Software Integrated Software Infrastructure Center leverages OSCAR technology to simplify deployment for the end-user as well as application developers.
- *Advances in Fusion Energy Sciences Contribute to ITER.* Efficient burning of the fusion's plasma fuel, a mixture of hydrogen isotopes, requires stably confining the plasma at temperatures of 50–100 million degrees, comparable to those found on the Sun, with magnetic fields designed to hold the plasma in place. Recent application of diagnostics that can measure the magnetic fields deep *inside* this highly energetic plasma with great precision and advanced computer codes that can model the detailed behavior of the plasma has given scientists unprecedented control over the behavior of the plasma. Experiments on the DIII–D tokamak have led the way in prototyping future experiments on ITER. Scientists are now able to use feedback control systems to confidently operate the plasma at pressures which optimize the fusion power output within a given magnetic field. In addition, experiments and the use of massively parallel computing to benchmark models that validate a whole new theoretical understanding of how plasmas can be insulated from loss of particles and energy give confidence that ITER can achieve the needed gain of 10 (50 Megawatts of heating, 500 Megawatts of fusion power production) required to enter the burning plasma regime.
- *Using DOE Technology and Know-how to Bring Sight to the Blind.* DOE's artificial retina project is a model for success in an era when the boundaries of scientific disciplines, public and private sector roles in science, and federal agency responsibilities are increasingly blurred. Success has come through the strength of partnerships between scientists in the public and private sectors, spanning scientific disciplines from materials to medicine to engineering to surgery, and with funds from both DOE and the National Institutes of Health (NIH). In June 2004, the project reached a major milestone as a sixth blind patient was successfully implanted with an artificial retina device. One patient has had the device since February 2002. All six patients can now read large letters (two-foot large letters one foot away) as well as tell the difference between a paper cup, a plate, and a plastic knife. The patients can also see colors although learning and understanding this process is still a challenge for both patients and scientists. Patients will soon begin using their retinal implants outside the laboratory and will even be able to use them alone at home. These initial patient studies are a key part of a Food and Drug Administration Investigational Device Exemption trial.
- *Record Operations Advance Physics at the Frontier.* Both the Fermi National Accelerator Laboratory (Fermilab) and the Stanford Linear Accelerator Center (SLAC) set significant new records in data delivery ("luminosity") in 2004, with the accelerators at each of these centers more than doubling their outstanding performance levels from 2003. On Friday, July 16, the Tevatron proton-antiproton collider at Fermilab set a new luminosity record of 1×10^{32} cm^{-2} sec^{-1}. The use of the Recycler and Accumulator together to maximize the number of antiprotons available for collisions helped to set the new record. Since January 2004, the peak luminosity of the Tevatron has increased 100 percent. The FY 2004 PEP–II/Babar run at SLAC ended as scheduled on July 31, setting new performance records. Since the SLAC facil-

ity for B meson research began operations in 1999, its accumulated total number of electron-positron collisions (integrated luminosity) has steadily increased to a level about five times higher than the design performance.

PROGRAM OBJECTIVES AND PERFORMANCE

Underpinning all of SC's programs is a fundamental quest for knowledge. Our program history provides a compelling story of how this knowledge has already shaped the world around us, and the future appears even more promising.

DOE's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and the environment) and seven subordinate general goals. The Office of Science supports the Science Goals. Detailing Office of Science contributions to DOE's Science goals are 27 annual performance goals. Progress toward the annual goals is tracked quarterly through the Department's Joule system and reported to the public annually through the Department's Performance and Accountability Report (PAR).

The one Office of Science annual performance goal that was not met in FY 2004 was: "Focus usage of the primary supercomputer at the NERSC on capability computing. 50 percent of the computing time used will be accounted for by computations that require at least 1/8 of the total resource." The allocation process for NERSC resources is based on the potential scientific impact of the work, rather than on how well the work scales to large numbers of processors. When we proposed this measure we did not understand the extent to which users who run large jobs also run small jobs. It is critical for users to be able to run their software at both scales on the same computer because it significantly simplifies their software management. Therefore we are reducing the percentage of time dedicated to large jobs at NERSC to 40 percent. In addition, we have tasked the NERSC Users Group to develop science-based measures to better assess NERSC performance.

As a basic research program, the meaning and impact of our performance goals may not always be clear to those outside the research community. The Office of Science has created a website *(www.sc.doe.gov/measures)* to better communicate what we are measuring and why it is important. We are committed to improving our performance information and will soon be expanding the information included on the website and simplifying the interface so that the program objectives and results will be accessible to a wide audience.

ORGANIZATION

The OneSC Project was initiated to streamline the Office of Science structure and improve operations across the Office of Science complex in keeping with the principles of the President's Management Agenda. The first phase of this multiphase effort is now complete and we have realigned the Office of Science organization structure to establish a clear set of integrated roles and responsibilities for all Headquarters (HQ) and Field elements (Figure 2). Policy direction, scientific program development and management functions were defined as HQ responsibilities. Program execution, implementation, and support functions were defined as Field responsibilities. The major structural change implemented is the removal of a layer of management from the Office of Science Field structure, in effect removing the layer that existed between the Office of Science Director and the Site Office Managers located at Office of Science laboratories. In addition, the Chicago Office will now serve as the personnel office for Office of Science employees in HQ. The second phase of the OneSC initiative will entail a reengineering of our business processes and is in the preliminary stages of development.

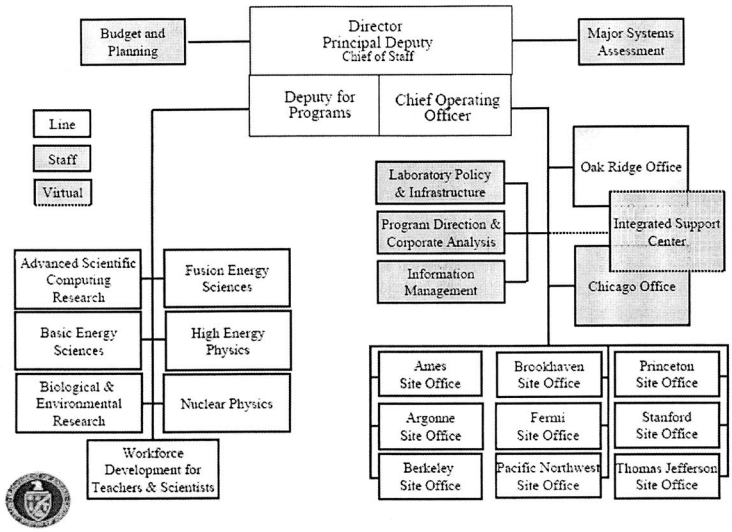

Figure 2

SCIENCE PROGRAMS

BASIC ENERGY SCIENCES

FY 2005 Comparable Appropriation—$1,104.6 Million; FY 2006 Request—$1,146.0 Million

The Basic Energy Sciences (BES) program advances nanoscale science through atomic- and molecular-level studies in materials sciences and engineering, chemistry, geosciences, and energy biosciences. BES also provides the Nation's researchers with world-class research facilities, including reactor- and accelerator-based neutron sources, light sources soon to include the X-ray free electron laser, nanoscale science research centers, and micro-characterization centers. These facilities provide outstanding capabilities for imaging and characterizing materials of all kinds from metals, alloys, and ceramics to fragile biological samples. The next steps in the characterization and the ultimate control of materials properties and chemical reactivity are to improve spatial resolution of imaging techniques; to enable a wide variety of samples, sample sizes, and sample environments to be used in imaging experiments; and to make measurements on very short time scales, comparable to the time of a chemical reaction or the formation of a chemical bond. With these tools, we will be able to understand how the composition of materials affects their properties, to watch proteins fold, to see chemical reactions, and to understand and observe the nature of the chemical bond. Theory, modeling, and computer simulations will also play a major role in achieving these outcomes and will be a companion to experimental work. Also supported is basic research aimed at advancing hydrogen production, storage, and use for the coming hydrogen economy.

FY 2006 will mark the completion of construction and the initial operation of the Spallation Neutron Source (SNS). The SNS will be significantly more powerful (by about a factor of 10) than the best spallation neutron source now in existence—ISIS at the Rutherford Laboratory in England. We estimate the facility will be used by 1,000–2,000 scientists and engineers annually from academia, national and federal labs, and industry for basic and applied research and for technology development. The high neutron flux (i.e., high neutron intensity) from the SNS will enable broad classes of experiments that cannot be done with today's low flux sources. For example, high flux enables studies of small samples, complex molecules and structures, time-dependent phenomena, and very weak interactions. The FY 2006 budget authority request completes funding for the SNS Project. This will involve procurement and installation of equipment for instrument systems, completion of an accel-

erator readiness review, commissioning of ring and target systems, and meeting all requirements to begin operations; and all SNS facilities will be turned over to operations. The estimated Total Project Cost remains constant at $1,411,700,000.

Operations will begin in FY 2006 at four of the five NSRCs: the Center for Nanophase Materials at ORNL, the Molecular Foundry at Lawrence Berkeley National Laboratory (LBNL), the Center for Integrated Nanotechnologies at Sandia National Laboratories/Los Alamos National Laboratory (SNL/LANL), and the Center for Nanoscale Materials at ANL. The exception is the Center for Functional Nanomaterials at BNL, which is scheduled to begin operations in FY 2008. The NSRCs are user facilities for the synthesis, processing, fabrication, and analysis of materials at the nanoscale. They are designed to promote rapid advances in the various areas of nanoscale science and technology and are part of the DOE contribution to the National Nanotechnology Initiative. The NSRCs are sited adjacent to or near existing BES synchrotron or neutron scattering facilities to enable rapid characterization of newly fabricated materials. FY 2006 funds are requested for construction of NSRCs located at LBNL, at SNL/LANL, and at BNL. Funds are also requested to complete the Major Item of Equipment (MIE) for the NSRC at ANL.

The Linac Coherent Light Source (LCLS) will continue Project Engineering Design (PED) and FY 2006 budget authority is requested to initiate physical construction of the LCLS conventional facilities. Funding will be provided separately for preconceptual design of instruments for the facility. BES funding will also be provided to partially support, in conjunction with the High Energy Physics program, operation of the SLAC linac. This will mark the beginning of the transition to LCLS operations at SLAC. The LCLS project will provide the world's first demonstration of an x-ray free-electron-laser (FEL) in the 1.5–15 A (angstrom) range, 10 billion times greater in peak power and peak brightness than any existing coherent x-ray light source, and that has pulse lengths measured in femtoseconds, the timescale of electronic and atomic motions. The advance in brightness is similar to that of a synchrotron over a 1960's laboratory x-ray tube. Synchrotrons have revolutionized science across disciplines ranging from atomic physics to structural biology. Advances from the LCLS are expected to be even more dramatic. The LCLS project leverages capital investments in the existing SLAC linac as well as technologies developed for linear colliders and for the production of intense electron beams with radio-frequency photocathode guns. The availability of the SLAC linac for the LCLS project creates a unique opportunity for demonstration and use of x-ray FEL radiation. The estimated Total Project Cost is $379,000,000.

The FY 2006 budget supports a Major Item of Equipment (MIE) for the Transmission Electron Aberration-corrected Microscope (TEAM). The Total Project Cost is in the range of $25,000,000 to $30,000,000. The TEAM project will construct and operate a new aberration-corrected electron microscope for materials and nanoscience research. The projected improvement in spatial resolution, contrast, sensitivity, and flexibility of design of electron optical instruments will provide unprecedented opportunities to observe directly the atomic-scale order, electronic structure, and dynamics of individual nanoscale structures.

Research to realize the potential of a hydrogen economy will be increased from $29,183,000 to $32,500,000. This research program is based on the BES workshop report *Basic Research Needs for the Hydrogen Economy.* The 2003 report highlights the enormous gap between our present capabilities for hydrogen production, storage, and use and those required for a competitive hydrogen economy. To be economically competitive with the present fossil fuel economy, the cost of fuel cells must be lowered by a factor of five and the cost of producing hydrogen must be lowered by a factor of four. Moreover, the performance and reliability of hydrogen technology for transportation and other uses must be improved dramatically. Simple incremental advances in the present state-of-the-art cannot bridge this gap. Narrowing the gap significantly is the goal of a comprehensive, long-range program of innovative high-risk/high-payoff basic research that is intimately coupled to and coordinated with the DOE's applied programs.

In order to accomplish these very high-priority, forefront activities, some difficult choices had to be made. In particular, the BES support for the Radiochemical Engineering and Development Center at ORNL will be terminated. The operations budgets of the remaining facilities will be at about the same level as in FY 2005, decreasing available beam time and service for users. Core funding for university and national laboratory researchers decreases 7.8 percent compared to the FY 2005 appropriation. While no research activities will be terminated, there will be reductions throughout.

ADVANCED SCIENTIFIC COMPUTING RESEARCH

FY 2005 Comparable Appropriation—$232.5 Million; FY 2006 Request—$207.1 Million

The Advanced Scientific Computing Research (ASCR) program significantly advances scientific simulation and computation, applying new approaches, algorithms, and software and hardware combinations to address the critical science challenges of the future. ASCR also provides access to world-class scientific computation and networking facilities to the Nation's scientific community to support advancements in practically every field of science. ASCR will continue to advance the transformation of scientific simulation and computation into the third pillar of scientific discovery, enabling scientists to look inside an atom or across a galaxy; and inside a chemical reaction that takes a millionth of a billionth of a second or across a climate change process that lasts for a thousand years. In addition, ASCR will shrink the distance between scientists and the resources—experiments, data, and other scientists—they need, and accelerate scientific discovery by making interactions that used to take months happen on a much shorter timescale.

The Mathematical, Information, and Computational Sciences (MICS) effort is responsible for carrying out the primary mission of the ASCR program. In addition, MICS research underpins the success of SciDAC. MICS supports both basic research and the development of the results from this basic research into software usable by scientists in other disciplines. MICS also supports partnerships with scientific discipline users to test the usefulness of the research—facilitating the transfer of research and helping to define promising areas for future research. This integrated approach is critical for MICS to succeed in providing the extraordinary computational and communications tools that DOE's civilian programs need to carry out their missions.

Major elements of the ASCR portfolio related to the SciDAC will be re-competed in FY 2006, with attention paid to support for the long-term maintenance and support of software tools such as mathematical libraries, adaptive mesh refinement software, and scientific data management tools developed in the first 5 years of the effort. In addition, in FY 2006 ASCR is changing the way in which it manages its Genomics: GTL partnership with the Biological and Environmental Research program. The management of these efforts will be integrated into the portfolio of successful SciDAC partnerships. The FY 2006 budget request includes $7,500,000 for continued support of the Genomics: GTL research program. The FY 2006 budget request also includes $2,600,000 for the Nanoscale Science, Engineering and Technology initiative led by BES, and $1,350,000 for support of the Fusion Simulation Project, led by the Fusion Energy Sciences program. ASCR's contributions to these partnerships will consist of advancing the mathematics and developing new mathematical algorithms to simulate biological systems and physical systems at the nanoscale. The FY 2006 budget request also provides $8,000,000 to initiate a small number of competitively selected SciDAC institutes at universities which can become centers of excellence in high end computational science in areas that are critical to DOE missions.

The FY 2006 budget also includes $8,500,000 to continue the "Atomic to Macroscopic Mathematics" (AMM) research support in applied mathematics needed to break through the current barriers in our understanding of complex physics processes that occur on a wide range of interacting length- and timescales. Achieving this basic mathematical understanding will provide enabling technology to virtually every challenging computational problem faced by SC.

The National Leadership Computing Facility acquired under the Next Generation Architecture (NGA) Leadership Class Computing Competition in FY 2004 will be operated to provide high performance production capability to selected Office of Science researchers. The NGA effort will play a critical role in enabling Leadership Class Machines that could lead to solutions for scientific problems beyond what would be attainable through a continued simple extrapolation of current computational capabilities. NGA will continue its focus on research in operating systems and systems software and will initiate a new competition for Research and Evaluation Prototype Computer testbeds. ASCR research efforts in Collaboratory Tools and Pilots and Networking will be restructured into an integrated Distributed Network Environment activity focused on basic research in computer networks and the middleware needed to make these networks tools for science. This change will enable the reduced NGA effort to operate computers acquired in FY 2004 and FY 2005 at the ORNL–Center for Computational Sciences (CCS) as tools for science and especially to satisfy the demand for resources that has resulted from the successful SciDAC efforts.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

FY 2005 Comparable Appropriation—$581.9 Million; FY 2006 Request—$455.7 Million

The Biological and Environmental Research (BER) program advances energy-related biological and environmental research in genomics and our understanding of complete biological systems, such as microbes that produce hydrogen; develops models to predict climate over decades to centuries; develops science-based methods for cleaning up environmental contaminants; provides regulators with a stronger scientific basis for developing future radiation protection standards; and develops new diagnostic and therapeutic tools, technology for disease diagnosis and treatment, non-invasive medical imaging, and biomedical engineering such as an artificial retina that is restoring sight to the blind.

The FY 2006 budget includes funds for the continued expansion of the Genomics: GTL program—a program at the forefront of the biological revolution. This program employs a systems approach to biology at the interface of the biological, physical, and computational sciences to address DOE's energy, environment, and national security mission needs. This research will continue to more fully characterize the inventory of multi-protein molecular machines found in selected DOE-relevant microbes and higher organisms. It will determine the diverse biochemical capabilities of microbes and microbial communities, especially as they relate to potential biological solutions to DOE needs, found in populations of microbes isolated from DOE-relevant sites. Support for Microbial Genomics research as a separate research activity is terminated to consolidate all microbial research within Genomics: GTL. Support of structural biology, human genome, and health effects research is also reduced to support GTL research. GTL research will provide the scientific community with knowledge, resources, and tools that benefit large numbers of research projects with positive impacts on more scientists and students than are negatively impacted by the initial reduction.

In 2003, the Administration launched the Climate Change Research Initiative (CCRI) to focus research on areas where substantial progress in understanding and predicting climate change, including its causes and consequences, is possible over the next five years. In FY 2006, BER will contribute to the CCRI from four programs: Terrestrial Carbon Processes, Climate Change Prediction, Atmospheric Radiation Measurement (ARM), and Integrated Assessment. Activities will be focused on (1) helping to resolve the magnitude and location of the North American carbon sink; (2) deploying and operating of a mobile ARM Cloud and Radiation Testbed facility to provide data on the effects of clouds and aerosols on the atmospheric radiation budget in regions and locations of opportunity where data are lacking or sparse; (3) using advanced climate models to simulate potential effects of natural and human-induced climate forcing on global and regional climate and the potential effects on climate of alternative options for mitigating increases in human forcing of climate; and (4) developing and evaluating assessment tools needed to study costs and benefits of potential strategies for reducing net carbon dioxide emissions.

The completion of the International Human Genome Project and the transition of BER's Human Genome research program from a human DNA sequencing program to a DNA sequencing user resource for the scientific community which focuses on the sequencing of scientifically important microbes, plants, and animals will bring BER's Human Genome Ethical, Legal, and Societal Issues (ELSI) program to an end. In FY 2006, ELSI research will include activities applicable to Office of Science issues in biotechnology and nanotechnology such as environmental or human health concerns associated with Genomics: GTL or nanotechnology research. Research with these funds will be coordinated across the Office of Science.

BER will focus FY 2006 research activities on higher priorities, including GTL and Climate Change Research, in support of DOE goals and objectives. Funding reductions are initiated in the Environmental Remediation Research subprogram and the Medical Applications and Measurement Science Research subprogram. Accordingly, some current research activities will be phased out in FY 2005. Based on findings of the BER Committee of Visitors for the Environmental Remediation Research subprogram, research activities are integrated into a single program to increase the efficiency of the activities and to better address the BER long-term goals in environmental remediation research.

HIGH ENERGY PHYSICS

FY 2005 Comparable Appropriation—$736.4 Million; FY 2006 Request—$713.9 Million

The High Energy Physics (HEP) program provides over 90 percent of the federal support for the Nation's high energy physics research. This research advances our understanding of dark energy and dark matter, the lack of symmetry in the current universe, the basic constituents of matter, and the possible existence of other dimensions, collectively revealing key secrets of the universe. HEP expands the energy frontier with particle accelerators to study fundamental interactions at the highest possible energies, which may reveal new particles, new forces, or undiscovered dimensions of space and time; explain the origin of mass; and illuminate the pathway to the underlying simplicity of the universe. At the same time, the HEP program sheds new light on other mysteries of the cosmos, uncovering what holds galaxies together and what is pushing the universe apart; understanding why there is any matter in the universe at all; and exposing how the tiniest constituents of the universe may have the largest role in shaping its birth, growth, and ultimate fate.

The HEP program in FY 2006 will continue to lead the world with forefront user facilities producing data that help answer key scientific questions, but these facilities will complete their scientific missions by the end of the decade. Thus, we have structured the FY 2006 HEP program not only to maximize the scientific returns on our investment in these facilities, but also to invest in R&D now for the most promising new facilities that will come online in the next decade. This has required a prioritization of our current R&D efforts to select those which will provide the most compelling science within the available resources. In making these decisions we have seriously considered the recommendations of the High Energy Physics Advisory Panel (HEPAP) and planning studies produced by the U.S. HEP community. This prioritization process will continue as the R&D programs evolve.

Because of its broad relevance in addressing many of the long-term goals of HEP, and its unique potential for new discoveries, the highest priority is given to the planned operations, upgrades and infrastructure for the Tevatron program at Fermilab. This includes the completion of the upgrade to the Tevatron accelerator complex in 2007 to provide increased luminosity and additional computational resources to support analysis of the anticipated larger volume of data. Over the last few years, the laboratory has developed and implemented a detailed, resource-loaded plan for Tevatron operations and improvements, which has resulted in more reliable luminosity projections. The Office of Science has reviewed the plan and is actively engaged in tracking its progress.

The FY 2006 request supports initial operations of the Neutrinos at the Main Injector (NuMI) project at Fermilab, which has just completed construction and will study the puzzling but fundamental physics of neutrino masses and mixings. The NuMI beam operates in parallel with the Tevatron, also at Fermilab, currently the highest energy accelerator in the world.

In order to fully exploit the unique opportunity to expand our understanding of the asymmetry of matter and antimatter in the universe, a high priority is given to the operations, upgrades and infrastructure for the B-factory at SLAC. Support for B-factory will include an allowance for increased power costs and fully funded upgrades for the accelerator and detector which are currently scheduled for completion in 2006. This includes the completion of the upgrade to the accelerator complex and BaBar detector to provide more data; additional computational resources to support analysis of the larger volume of data; and, increased infrastructure spending to improve reliability. Funding for SLAC operations includes support from the BES program for the LCLS project, marking the beginning of the transition of Linac operations from HEP to BES as B-factory operations are terminated by FY 2008 at the latest.

As the Large Hadron Collider (LHC) accelerator in Europe nears its turn-on date of 2007, U.S. activities related to fabrication of detector components will be completed and new activities related to commissioning and pre-operations of these detectors, along with software and computing activities needed to analyze the data, will ramp-up significantly. Support of a leadership role for U.S. research groups in the LHC physics program will continue to be a high priority for the HEP program.

In order to explore the nature of dark energy, pre-conceptual R&D for potential interagency sponsored experiments with NASA will continue in FY 2006. These experiments will provide important new information about the nature of dark energy and dark matter that will in turn lead to a better understanding of the birth, evolution and ultimate fate of the universe. At this time, no funding for a space-based DOE/NASA Joint Dark Energy Mission past the pre-conceptual stage has been identified.

The engineering design of the BTeV ("B Physics at the Tevatron") experiment, which was scheduled to begin in FY 2005 as a new Major Item of Equipment, is cancelled. This is consistent with the guidance of HEPAP which rated BTeV as of lesser scientific potential than other projects, although still important scientifically

and of the Particle Physics Project Prioritization Panel (P5) which supported BTeV but only if it could be completed by 2010, which is not feasible given schedule and funding constraints.

The Linear Collider has been judged to be of the highest scientific importance by HEPAP as well as by scientific advisory bodies of the Asian and European HEP communities. In order to address the opportunity for significant new future research options, R&D in support of an international electron-positron linear collider is increased relative to FY 2005 to support the continued international participation and leadership in linear collider R&D and planning by U.S. scientists.

Recent discoveries and studies have pointed to neutrinos as being an extremely important area of research for deepening our understanding of the nature of matter and the structure of the universe, and HEP is working with the Nuclear Physics program and the National Science Foundation to plan a coordinated program in neutrino physics. To provide a nearer-term future program, and to preserve future research options, R&D for other new accelerator and detector technologies, particularly in the emerging area of neutrino physics, will increase.

NUCLEAR PHYSICS

FY 2005 Comparable Appropriation—$404.8 Million; FY 2006 Request—$370.7 Million

The Nuclear Physics (NP) program is the major sponsor of fundamental nuclear physics research in the Nation, providing about 90 percent of federal support. NP builds and operates world-leading scientific facilities and state-of-the-art instrumentation to study the evolution and structure of nuclear matter, from the smallest building blocks, quarks and gluons, to the stable elements in the Universe created by stars and to understand how the quarks and gluons combine to form the nucleons (proton and neutron), what are the properties and behavior of nuclear matter under extreme conditions of temperature and pressure, and what are the properties and reaction rates for atomic nuclei up to their limits of stability. Results and insight from these studies are relevant to understanding how the universe evolved in its earliest moments, how the chemical elements were formed, and how the properties of one of nature's basic constituents, the neutrino, influences astrophysics phenomena such as supernovae. Scientific discoveries at the frontiers of nuclear physics further the Nation's energy related research capacity, in turn contributing to the Nation's security, economic growth and opportunities, and improved quality of life.

In FY 2006 the NP program will operate world-leading user facilities and make investments that will produce data and develop the research capabilities to achieve the scientific goals discussed above. The Budget Request reflects a balance in ongoing facility operations and research support, and investments in capabilities. The FY 2006 budget request provides the resources to operate the program's user facilities at 65 percent of optimum utilization with investments allocated so as to optimize their scientific programs. FY 2006 investments in capital equipment address opportunities identified in the 2002 Long Range Plan of the Nuclear Sciences Advisory Committee (NSAC) and in subsequent recommendations.

In FY 2006 the Relativistic Heavy Ion Collider's (RHIC) beams of relativistic heavy ions will be used by approximately 1000 scientists to continue the exploration of the nature of hot, dense matter and to recreate conditions under which nuclear matter dissolves into the predicted quark-gluon plasma. RHIC started operations in FY 2000 and its first 3 runs have produced over 70 refereed journal papers, creating great interest in the scientific community with the observation of a new state of nuclear matter. In FY 2006 funds are provided for accelerator improvements that will increase accelerator reliability and reduce costs, for detector upgrades needed to characterize the new state of matter observed and for Research and Development to increase the luminosity of the collider. These investments are important for optimizing the scientific research and productivity of the facility. These investments are made at the expense of operating time. FY 2006 funding will support 1,400 hours of operations, a 31 percent utilization of the collider. Effective operation will be achieved by combining FY 2006–FY 2007 running into a single back-to-back run bridging the two Fiscal Years.

Operations of the Thomas Jefferson National Accelerator Facility (TJNAF) in FY 2006 will continue to advance our knowledge of the internal structure of protons and neutrons, the basic constituents of all nuclear matter. By providing precision experimental information concerning the quarks and gluons that form the protons and neutrons, the approximately 1,000 experimental researchers, together with researchers in nuclear theory, seek to provide a quantitative description of nuclear matter in terms of the fundamental theory of the strong interaction, Quantum

ChromoDynamics. In FY 2006 funds are provided to continue R&D activities for a potential 12 GeV Upgrade of the Continuous Electron Beam Accelerator Facility (CEBAF). These investments will poise the facility for a cost-effective upgrade that would allow insight on the mechanism of "quark confinement"—one of the compelling unanswered puzzles of physics.

In the FY 2006 request funds are provided for the operation of the Argonne Tandem Linac Accelerator System (ATLAS) at ANL and the Holifield Radioactive Ion Beam Facility (HRIBF) at ORNL, for studies of nuclear reactions, structure and fundamental interactions. Included in this funding are capital equipment and accelerator improvement project funds provided to each facility for the enhancement of the accelerator systems and experimental equipment. These low energy facilities will carry out about 80 experiments in FY 2006 involving about 300 U.S. and foreign researchers.

In FY 2006, funds are provided to continue the fabrication of a next generation gamma-ray detector array (GRETINA) and of the Fundamental Neutron Physics Beamline (FNPB) at the Spallation Neutron Source (SNS) that will provide the U.S. with world-leader capabilities in nuclear structure and fundamental neutron studies, respectively. Support continues for completion of the important neutrino experiments at the Sudbury Neutrino Observatory (SNO) and KamLAND.

The research programs at the major user facilities are integrated partnerships between DOE scientific laboratories and the university community, and the planned experimental research activities are considered essential for scientific productivity of the facilities. Funding for university and national laboratory researchers and graduate students decreases 6.8 percent compared to the FY 2005 appropriation.

While we have a relatively good understanding of the origin of the chemical elements in the cosmos lighter than iron, the production of the elements from iron to uranium remains a puzzle. The proposed Rare Isotope Accelerator (RIA) would enable study of exotic nuclei at the very limits of stability, advancing our knowledge of how the elements formed. In FY 2006, R&D activities for the proposed RIA are maintained at the FY 2005 Congressional budget request level.

FUSION ENERGY SCIENCES

FY 2005 Comparable Appropriation—$273.9 Million; FY 2006 Request—$290.6 Million

The Fusion Energy Sciences (FES) program advances the theoretical and experimental understanding of plasma and fusion science, including a close collaboration with international partners in identifying and exploring plasma and fusion physics issues through specialized facilities. This includes: 1) exploring basic issues in plasma science; 2) developing the scientific basis and computational tools to predict the behavior of magnetically confined plasmas; 3) using the advances in tokamak research to enable the initiation of the burning plasma physics phase of the FES program; 4) exploring innovative confinement options that offer the potential of more attractive fusion energy sources in the long-term; 5) focusing on the scientific issues of nonneutral plasma physics and High Energy Density Physics (HEDP); and 6) developing the cutting edge technologies that enable fusion facilities to achieve their scientific goals. FES also leads U.S. participation in ITER, an experiment to study and demonstrate the sustained burning of fusion fuel. This international collaboration will provide an unparalleled scientific research opportunity with a goal of demonstrating the scientific and technical feasibility of fusion power.

The FY 2006 request is $290,550,000, an increase of $16,647,000, 6.1 percent over the FY 2005 Appropriation. The FY 2006 budget continues the redirection of the fusion program to prepare for and participate in the ITER project. The ITER International Agreement is currently being negotiated and is expected to be completed by the end of FY 2005. FY 2006 FES funding of $49,500,000 is for the startup of the U.S. Contributions to ITER MIE. The total U.S. Contributions to the ITER MIE, $1,122,000,000, supports the fabrication of the equipment, provision of personnel, limited cash for the U.S. share of common project expenses at the ITER site, and ITER procurements. This MIE is augmented by the technical output from a significant portion of the U.S. Fusion Energy Sciences community research program. Virtually the entire FES program provides related contributions to such ITER relevant research and prepares the U.S. for effective participation in ITER when it starts operations.

Within the overall priorities of the FY 2006 FES budget, $15,900,000 is requested for the National Compact Stellarator Experiment (NCSX), a joint ORNL/Princeton Plasma Physics Laboratory (PPPL) advanced stellarator experiment being built at PPPL. This fusion confinement concept has the potential to be operated without plasma disruptions, leading to power plant designs that are simpler and more reli-

able than those based on the current lead concept, the tokamak. FY 2006 operation of the three major fusion research facilities will be reduced from a total of 48 weeks to 17 weeks.

FY 2006 funding for the Inertial Fusion Energy/High Energy Density Physics program is $8,086,000, a reduction of $7,255,000 from the FY 2005 level. This will be accomplished by reducing the level of research on heavy ion beams. In addition, the Materials Research program will be eliminated in favor of utilizing the general BES materials effort for scientific advances in areas of fusion interest.

SCIENCE LABORATORIES INFRASTRUCTURE

FY 2005 Comparable Appropriation—$42.0 Million; FY 2006 Request—$40.1 Million

The mission of the Science Laboratories Infrastructure (SLI) program is to enable the conduct of DOE research missions at the Office of Science laboratories by funding line item construction projects to maintain the general purpose infrastructure and the clean up for reuse or removal of excess facilities. The program also supports Office of Science landlord responsibilities for the 24,000 acre Oak Ridge Reservation and provides Payments in Lieu of Taxes (PILT) to local communities around ANL–East, BNL, and ORNL.

In FY 2006, General Plant Projects (GPP) funding is requested to refurbish and rehabilitate the general purpose infrastructure necessary to perform cutting edge research throughout the Office of Science laboratory complex. FY 2006 funding of $3,000,000 is requested to support continued design of the Pacific Northwest National Laboratory (PNNL) Capabilities Replacement Laboratory project. Funding of $11,046,000 is requested to accelerate decontamination and decommissioning (D&D) of the Bevatron Complex at the LBNL.

No funding is requested under the Health and Safety Improvements subprogram to continue health and safety improvements at the Office of Science laboratories identified in the Occupational Safety & Health Administration (OSHA) and Nuclear Regulatory Commission (NRC) reviews. If the Administration determines that health and safety issues remain, resources will be requested in future years as necessary.

SCIENCE PROGRAM DIRECTION

FY 2005 Comparable Appropriation—$153.7 Million; FY 2006 Request—$162.7 Million

Science Program Direction (SCPD) enables a skilled, highly motivated federal workforce to manage the Office of Science's basic and applied research portfolio, programs, projects, and facilities in support of new and improved energy, environmental, and health technologies. SCPD consists of two subprograms: Program Direction and Field Operations.

The Program Direction subprogram is the single funding source for the Office of Science federal staff in headquarters responsible for managing, directing, administering, and supporting the broad spectrum of Office of Science disciplines. This subprogram includes planning and analysis activities, providing the capabilities needed to plan, evaluate, and communicate the scientific excellence, relevance, and performance of the Office of Science basic research programs. Additionally, Program Direction includes funding for the Office of Scientific and Technical Information (OSTI) which collects, preserves, and disseminates research and development (R&D) information of the Department of Energy (DOE) for use by DOE, the scientific community, academia, U.S. industry, and the public to expand the knowledge base of science and technology. The Field Operations subprogram is the funding source for the federal workforce in the Field responsible for management and administrative functions performed within the Chicago and Oak Ridge Operations Offices, and site offices supporting the Office of Science laboratories and facilities.

WORKFORCE DEVELOPMENT FOR TEACHERS AND SCIENTISTS

FY 2005 Comparable Appropriation—$7.6 Million; FY 2006 Request—$7.2 Million

The mission of the Workforce Development for Teachers and Scientists (WDTS) program is to provide a continuum of educational opportunities to the Nation's students and teachers of science, technology, engineering, and mathematics (STEM).

The Scientists Teaching and Reaching Students (STARS) education initiative was launched in FY 2004 to promote science literacy and help develop the next generation of scientists and engineers. In support of this effort, additional FY 2006 funding is requested for both the Laboratory Science Teacher Professional Development (LSTPD) activity and the Middle School Science Bowl. The LSTPD activity is a three-year commitment experience for K–14 teachers and faculty. The LSTPD will

run at five or more DOE national laboratories with about 105 participating STEM teachers, in response to the national need for science teachers who have strong content knowledge in the classes they teach.

The Faculty Sabbatical activity, which is being initiated in FY 2005 for 12 faculty members from Minority Serving Institutions (MSI), will have five positions available in FY 2006. The Faculty Sabbatical is aimed at providing sabbatical opportunities to faculty members from MSIs to facilitate the entry of their faculty into the research funding mainstream. This activity is an extension of the successful Faculty and Student Teams (FaST) program where teams consisting of a faculty member and two or three undergraduate students from colleges and universities with limited prior research capabilities work with mentor scientists at a national laboratory on a research project that is formally documented in a paper or presentation.

In the FY 2006 request, the Pre-Service Teachers (PST) activity will be run at one national laboratory, as opposed to twelve national laboratories in FY 2005, and students will be recruited from participating National Science Foundation (NSF) programs.

SAFEGUARDS AND SECURITY

FY 2005 Comparable Appropriation—$67.2 Million; FY 2006 Request—$68.7 Million

The Safeguards and Security (S&S) program ensures appropriate levels of protection against unauthorized access, theft, diversion, loss of custody, or destruction of DOE assets and hostile acts that may cause adverse impacts on fundamental science, national security or the health and safety of DOE and contractor employees, the public or the environment. The SC's Integrated Safeguards and Security Management strategy encompasses a tailored approach to safeguards and security. As such, each site has a specific protection program that is analyzed and defined in its individual Security Plan. This approach allows each site to design varying degrees of protection commensurate with the risks and consequences described in their site-specific threat scenarios.

The FY 2006 request meets minimum, essential security requirements. Protection of employees and visitors is of primary concern, as well as protection of special nuclear material and research facilities, equipment and data. Priority attention is given to protective forces, physical security systems, and cyber security.

CONCLUSION

The Office of Science occupies a unique and critical role within the U.S. scientific enterprise. We fund research projects in key areas of science that our nation depends upon. We construct and operate major scientific user facilities that scientists from virtually every discipline are using on a daily basis, and we manage civilian national laboratories that are home to some of the best scientific minds in the world.

Madame Chairman, we have made some difficult decisions this year within the President's budget request for the Office of Science—consistent with our research priorities—which will allow us to build on the solid foundation created over the last four years, propel us into new areas of great scientific promise, and maintain America's world-class stature in science.

I want to thank you, Madame Chairman, for providing this opportunity to discuss the Office of Science research programs and our contributions to the Nation's scientific enterprise. On behalf of DOE, I am pleased to present this FY 2006 budget request for the Office of Science.

This concludes my testimony. I would be pleased to answer any questions you might have.

BIOGRAPHY FOR RAYMOND L. ORBACH

Dr. Raymond L. Orbach was sworn in as the 14th Director of the Office of Science at the Department of Energy (DOE) on March 14, 2002. As Director of the Office of Science (SC), Dr. Orbach manages an organization that is the third largest federal sponsor of basic research in the United States and is viewed as one of the premier science organizations in the world. The SC fiscal year 2005 budget of $3.6 billion funds programs in high energy and nuclear physics, basic energy sciences, magnetic fusion energy, biological and environmental research, and computational science. SC, formerly the Office of Energy Research, also provides management oversight of the Chicago and Oak Ridge Operations Offices and 10 DOE non-weapons laboratories.

Prior to his appointment, Dr. Orbach served as Chancellor of the University of California (UC), Riverside from April 1992 through March 2002; he now holds the title Chancellor Emeritus. During his tenure as Chancellor, UC–Riverside grew

from the smallest to one of the most rapidly growing campuses in the UC system. Enrollment increased from 8,805 to more than 14,400 students with corresponding growth in faculty and new teaching, research, and office facilities.

In addition to his administrative duties at UC–Riverside, Dr. Orbach maintained a strong commitment to teaching. He sustained an active research program; worked with postdoctoral, graduate, and undergraduate students in his laboratory; and taught the freshman physics course each winter quarter. As Distinguished Professor of Physics, Dr. Orbach set the highest standards for academic excellence. From his arrival, UC–Riverside scholars led the Nation for seven consecutive years in the number of fellows elected to the prestigious American Association for the Advancement of Science (AAAS).

Dr. Orbach began his academic career as a postdoctoral fellow at Oxford University in 1960 and became an Assistant Professor of Applied Physics at Harvard University in 1961. He joined the faculty of the University of California, Los Angeles (UCLA) two years later as an Associate Professor, and became a Full Professor in 1966. From 1982 to 1992, he served as the Provost of the College of Letters and Science at UCLA.

Dr. Orbach's research in theoretical and experimental physics has resulted in the publication of more than 240 scientific articles. He has received numerous honors as a scholar including two Alfred P. Sloan Foundation Fellowships, a National Science Foundation Senior Postdoctoral Fellowship, a John Simon Guggenheim Memorial Foundation Fellowship, the Joliot Curie Professorship at the Ecole Superieure de Physique et Chimie Industrielle de la Ville de Paris, the Lorentz Professorship at the University of Leiden in the Netherlands, and the 1991–1992 Andrew Lawson Memorial Lecturer at UC–Riverside. He is a fellow of the American Physical Society and the AAAS.

Dr. Orbach has also held numerous visiting professorships at universities around the world. These include the Catholic University of Leuven in Belgium, Tel Aviv University, and the Imperial College of Science and Technology in London. He also serves as a member of 20 scientific, professional, or civic boards.

Dr. Orbach received his Bachelor of Science degree in Physics from the California Institute of Technology in 1956. He received his Ph.D. degree in Physics from the University of California, Berkeley, in 1960 and was elected to Phi Beta Kappa.

Dr. Orbach was born in Los Angeles, California. He is married to Eva S. Orbach. They have three children and seven grandchildren.

Chairwoman BIGGERT. Thank you very much, Dr. Orbach.

And Mr. Faulkner, you are recognized for five minutes.

STATEMENT OF MR. DOUGLAS L. FAULKNER, PRINCIPAL DEPUTY ASSISTANT SECRETARY FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY, THE DEPARTMENT OF ENERGY, WASHINGTON, DC

Mr. FAULKNER. Thank you, ma'am.

Madame Chairman, Ranking Member, as my entire statement is part of the record, I will briefly summarize.

The President's budget includes $1.2 billion for my office, the Office of Energy Efficiency and Renewable Energy, and I am pleased to outline our priorities for the funding.

Our top priority is to reduce America's dependence on foreign oil. Since the majority of oil we consume is used to fuel transportation, we are seeking increases in both our vehicle technologies programs and our hydrogen and fuel cell programs, proposing to spend nearly $349 million in these areas. Our work, conducted in partnership with auto makers and energy providers, among others, includes gasoline-electric hybrid vehicles, propulsion, new generations of spark and compression ignition internal combustion engines, vehicle systems, lightweight materials, and of course, hydrogen fuel cells and the elements of hydrogen refueling infrastructure to support them.

Our next priority is to reduce the burden of energy prices on the disadvantaged. To this end, we are proposing $230 million for the

low-income weatherization program, an increase over last year's appropriated levels.

Another priority of my office is to increase the viability and deployment of renewable energy technologies. To this end, we are seeking approximately $260 million. This funding includes our work on solar, wind, biomass, geothermal, hydropower, and the facilities and activities needed to support these programs.

Our next priority is to increase the energy efficiency of buildings and appliances. To this end, we are seeking more than $75 million for our building technology program, ENERGY STAR, Rebuild America, and building code training and assistance activities.

Our fifth priority is to spur the creation of the domestic bioindustry, which we also addressed in previous priorities. In pursuit of this priority, we are seeking over $72 million for our biomass technologies program. Our work in this area includes lowering the cost of sugars derived from discarded or under-utilized cellulosic materials from which ethanol and other chemicals or products could be made.

Our sixth priority is to increase the efficiency and performance of distributed power generation, which can enhance the reliability of the entire electricity grid. We propose to spend nearly $57 million on our distributed energy program. That includes work on advanced reciprocating engines, microturbines, thermally-activated technologies, and the packing and integration of these technologies into compact, affordable systems.

Our seventh priority is to increase the energy efficiency of industry. And to that end, we are seeking $56.5 million for our industry and technologies program. Technologies we are working on are as varied as continuous-melt electric arc furnaces, cookless iron-making, and high-pressure superboilers. We are also continuing efforts to communicate best energy efficiency practices among a wide variety of industrial partners.

Our eighth priority is to assist the largest single energy user in the U.S. economy: the Federal Government. We want them to lead by example on using energy more efficiently and procuring more energy from renewable resources. In pursuit of this goal, we operate FEMP, the Federal Energy Management Program and our Departmental Energy Management Program with over $19 million of funding.

Madame Chairman, this is an extremely diverse portfolio of activities, and sometimes they are challenging to manage. This is why our ninth priority has been to change and continuously improve the way we do business. The National Academy of Public Administration, in a study it released a few years ago, five years ago, in the last Administration, found that the Office of Energy Efficiency and Renewable Energy, suffered from fragmentation management flaws, including emphasis on process over product, lack of staff motivation, lack of commitment to organizational goals, poor communications, which is usually due to uncoordinated and poorly designed information support systems and weak decision-making processes.

Following the complete reorganization of our office in July of 2002, the Academy went in and evaluated our office again. After an 18-month study, the Academy found that my office had

strengthened program management and executed a sound business model. In the words of the Academy, "EERE has demonstrated that much can be achieved in a relatively short period if top management is committed to doing so. The leadership of DOE should examine what this office has accomplished and consider whether a similar approach would benefit other parts of the Department."

While there is still a great deal yet to do to improve our performance, we are embracing the thoughtful guiding principles that this subcommittee has stressed. Among them: greater competition, five-year planning, improved program management while continuing ahead with the refinement and implementation of an innovative business model.

With that, Madame Chairman, I would be pleased to take any questions.

[The prepared statement of Mr. Faulkner follows:]

PREPARED STATEMENT OF DOUGLAS L. FAULKNER

Madam Chairman and Members of the Subcommittee, I appreciate the opportunity to testify on the President's Fiscal Year 2006 Budget Request for the Office of Energy Efficiency and Renewable Energy (EERE). My focus today will be on the energy conservation, renewable energy, and hydrogen activities within our research and development programs.

The President's FY 2006 Budget includes $1.2 billion for EERE. In his February 2nd State of the Union Address, the President underscored the need to restrain spending in order to sustain our economic prosperity. As part of this restraint, it is important that total discretionary and non-security spending be held to levels proposed in the FY 2006 Budget. The budget savings and reforms in the Budget are important components of achieving the President's goal of cutting the budget deficit in half by 2009 and we urge the Congress to support these reforms. The FY 2006 Budget includes more than 150 reductions, reforms, and terminations in non-defense discretionary programs, of which one affects EERE's programs. The Department wants to work with the Congress to achieve these savings.

The programs funded by this appropriation continue support for certain Presidential initiatives; build on research, development, and deployment successes already achieved; and focus on implementing results-oriented business practices to help achieve strategic energy goals and fulfill the Department's mission.

EERE has made good on its strategic goal of "changing the way it does business." Last fall, the National Academy of Public Administration (NAPA) completed an 18-month review of EERE's reorganized structure and noted in its final report, *Reorganizing for Results,* that "the basic construct of the reorganization—eliminating the sector organizations and restructuring around the major programs, and consolidating the business administration functions-was sound," and that "EERE has made great strides to reinvent how it does business." Our innovative business and management model is enabling EERE to fund the right mix of research and development (R&D) and to get more technical work done effectively with the R&D dollars appropriated. EERE is also guided by the research and development investment criteria (RDIC) called for in the President's Management Agenda, as well as the Office of Management and Budget's (OMB) Program Assessment Rating Tool (PART) to guide its decisions and focus its R&D on long-term, high-payoff activities that require federal involvement to be successful.

A primary long-term goal for our nation must be to significantly reduce our dependence on foreign oil, and to develop the technologies that enable Americans to make greater use of our abundant, clean, domestic renewable energy resources. EERE's FY 2006 request continues support for the President's *Hydrogen Fuel Initiative* to ensure that hydrogen production, storage, and infrastructure technologies will be available and affordable when hydrogen-powered fuel cell vehicles are ready for commercialization. EERE also continues support for its *FreedomCAR* program (where CAR stands for Cooperative Automotive Research), working with industry to improve the efficiency and lower the cost of advanced combustion engines and hybrid vehicle technologies. In addition, EERE will pursue critical technical improvements to biorefineries and the processes that use biomass, the only renewable resource that can directly produce liquid transportation fuels such as ethanol.

But long-term results are only part of the story for EERE's programs. The Fiscal Year 2006 Budget Request is designed to provide results to the American people today by advancing technologies that are making their way into energy-related products and services that are an integral part of America's energy economy. Since 2001, research sponsored by EERE has won 37 R&D 100 awards, ten in 2004 alone. One technology winner this year is the world's first portable, flexible photovoltaic (PV) power module made from thin-film copper indium gallium selenide (CIGS). The U.S. Army is already using these lightweight PV systems that can be folded as small as a 9 by 12 envelope, stowed in a small backpack, and easily carried over long distances to supply efficient and reliable power.

Targeting all sectors of energy use, EERE's Fiscal Year 2006 activities are designed to make a difference in the everyday lives of Americans today, and an even greater difference in years to come.

ENERGY CONSERVATION AND RENEWABLE ENERGY PROGRAMS FISCAL YEAR 2006 REQUEST

EERE programs funded by the Energy and Water Development appropriation include Hydrogen and Fuel Cell Technologies, Vehicle Technologies, Solar Energy Technologies, Wind and Hydropower Technologies, Geothermal Technologies, Biomass and Biorefinery Systems, Weatherization and Intergovernmental, Distributed Energy Resources, Building Technologies, Industrial Technologies, Federal Energy Management, and Program Management and Direction.

HYDROGEN AND FUEL CELL TECHNOLOGIES

The Fiscal Year 2006 Budget Request for Hydrogen and Fuel Cell Technologies totals $182.7 million: $99.1 million for hydrogen activities, a $5.1 million increase over the Fiscal Year 2005 comparable appropriation, and $83.6 million for fuel cell activities, an $8.7 million increase. Hydrogen and fuel cell technologies are the foundation of the President's *Hydrogen Fuel Initiative* and help support the Department's *FreedomCAR* program. Under the *FreedomCAR and Fuel Partnership,* government and industry are working together on research activities to overcome key technical barriers to commercialization of advanced efficient vehicles, and to facilitate a fuel cell hybrid vehicle and hydrogen infrastructure commercialization decision by industry in the year 2015. Because hydrogen fuel cell vehicles emit no criteria pollutants or carbon dioxide, their development and commercial success would essentially remove light-duty transportation as an environmental issue. The hydrogen will be produced from diverse domestic resources, making our nation self-reliant for our personal transportation energy needs.

Much of the proposed increase in Hydrogen Technology is to accelerate and expand research and development of advanced technologies for producing hydrogen using renewable feedstocks such as biomass and renewable energy sources such as wind and solar. The program is also developing technologies for distributed hydrogen production from reforming of natural gas and from electrolysis. Other priorities include development of on-board vehicular hydrogen storage systems to achieve a driving range of greater than 300 miles and development of hydrogen delivery technologies. The ultimate goal is to reduce the cost of producing, storing, and delivering hydrogen to a cost competitive with that of gasoline.

Validation of fuel cell vehicle and hydrogen infrastructure technologies under 'real-world ' operating conditions is essential to track progress and to help guide research priorities. This year's request contains $24 million for fuel cell technology validation which is a 35 percent increase over the Fiscal Year 2005 comparable appropriation. We are also requesting $14.9 million in funding for the validation of hydrogen infrastructure technology, a 58 percent increase over the Fiscal Year 2005 comparable appropriation. Automotive and energy partners are matching public dollars on a "50–50" cost-shared basis, and the Department is beginning to receive essential statistical data on the status of fuel cell vehicle and infrastructure technologies relative to targets in the areas of efficiency, durability, storage system range, and fuel cost. By measuring progress under real-world driving conditions, the Department can accurately monitor success in overcoming remaining fuel cell and infrastructure technology barriers and assess progress towards the 2015 commercialization decision by industry. These activities also provide technical information and analysis to support the development of codes and standards for the commercial use of hydrogen, and feedback on vehicle and infrastructure safety. Fiscal Year 2006 activities include opening eight hydrogen fueling stations, assessing performance and cost of hydrogen production and delivery technologies, and validating 1,000 hours of fuel cell vehicle durability "on the road." By 2009, the program is expected to validate fuel cell vehicle durability of 2,000 hours, a 250-mile vehicle range, and hydrogen production cost of less than $3.00/gge (gasoline gallon equivalent).

As highlighted by Secretary Bodman in earlier Congressional testimony, I am pleased to report that our fuel cell activities achieved an important technology cost goal this past year when they reduced the high-volume cost of automotive fuel cells from $275 per kilowatt in 2002 to $200 per kilowatt in 2004. This accomplishment is a major step toward the program's goal of reducing the cost of transportation fuel cell power systems to $45 per kilowatt by 2010.[1] Research successes like this will enable a positive commercialization decision in 2015 that could lead to the market introduction of hydrogen fuel cell vehicles by 2020.

The President's *Hydrogen Fuel Initiative* was received by Congress with enthusiasm, and we appreciate this subcommittee's support. However, while the EERE Fiscal Year 2005 comparable appropriation for hydrogen technology was $94 million, 40 percent of those funds were earmarked for specific projects that are not wholly consistent with our research plan or the recommendations of the National Research Council. As a consequence, we must delay some very important work in areas such as hydrogen production and storage, and our ability to meet our established research targets in the specified timeframes may be in jeopardy. The Department looks forward to working with Congress to help ensure that the projects supported are consistent with our established goals in an effort to keep our progress on track.

VEHICLE TECHNOLOGIES

The *FreedomCAR* & Vehicle Technologies Program focuses on the development of more energy efficient and environmentally friendly technologies for cars and trucks that will use significantly less oil, and still preserve America's freedom of mobility. Many of these technologies also serve as the foundation of tomorrow's hydrogen fuel cell vehicles.

The Fiscal Year 2006 Budget Request for Vehicle Technologies is $165.9 million, a $0.5 million increase over the Fiscal Year 2005 comparable appropriation. Activities in this program contribute to two Departmental initiatives: the *FreedomCAR* initiative and the *21st Century Truck* initiative.

FreedomCAR activities in Fiscal Year 2006 focus on innovative, high-efficiency vehicle technologies including advanced combustion engines, advanced fuel formulations, hybrid vehicle systems, high-powered batteries, lightweight materials, and power electronics. These critical technologies can lead to near-term oil savings when used with advanced combustion hybrid electric vehicles and support the future development of hydrogen fuel cell hybrid vehicles.

FreedomCAR goals include increasing passenger and light-duty vehicle combustion engine efficiency from 30 percent to 45 percent by 2010 (while meeting 2010 EPA emissions standards), and reducing the cost of high-power batteries for hybrid vehicles from $3000 (1998 baseline) to $500 for a 25kW battery by 2010. Combustion engine efficiency is making good progress, and in Fiscal Year 2006 we expect to reach 41 percent efficiency, a major step towards the 2010 goal of 45 percent. Battery technologies have also made significant progress toward these goals: the program reached its $1,000 cost target for Fiscal Year 2004, and the Fiscal Year 2006 budget is expected to bring that down to $750.

The *21st Century Truck* initiative has similar objectives but is focused on commercial vehicles. The 2006 request will fund cooperative research efforts between the commercial heavy-duty vehicle (trucks and buses) industry and major federal agencies to develop technologies that will make our nation's commercial vehicles more efficient, cleaner, and safer. The effort centers on R&D to improve engine systems, heavy-duty hybrids, truck safety, and to reduce parasitic losses (e.g., aerodynamic drag as the vehicle moves down the road at 60 mph, and the power drain from belt driven accessories like power steering and air conditioning) and engine idling.

In Fiscal Year 2004, the heavy-duty vehicle activity demonstrated a reduction of parasitic losses from 39 percent baseline to 27 percent in a laboratory setting, and activities included in the Fiscal Year 2006 budget are expected to bring those losses down to 24 percent. The program also demonstrated an increase in heavy-duty diesel engine efficiency from the baseline of 40 percent to 45 percent in Fiscal Year 2004 (while meeting EPA 2007 emission standards) and we expect the Fiscal Year 2006 budget to raise that to 50 percent (while meeting EPA 2010 emission standards)—important steps toward meeting our long-term goal of 55 percent energy efficiency in 2013.

SOLAR ENERGY TECHNOLOGIES

The Solar Energy Technologies Program focuses research on advanced solar devices that can bring reliable and affordable solar energy technologies into the mar-

[1] Cost of 50 kW vehicle fuel cell power systems estimated for production rate of 500,000 units per year.

ketplace, helping our nation meet electricity needs and reducing the stress on our critical electricity infrastructure. The Department's efforts are directed in the interrelated areas of photovoltaics, concentrating solar power (CSP), and solar heating and lighting. The Fiscal Year 2006 Budget Request for solar technology is $84.0 million, which is roughly equivalent to the Fiscal Year 2005 comparable appropriation of $85.1 million.

The Department's photovoltaic research and development is focused on next-generation technologies such as thin-film photovoltaic cells and leap-frog technologies such as polymers and nanostructures. The Fiscal Year 2006 request of $75.0 million for photovoltaic energy systems includes $31.4 million for critical laboratory research, $28.6 million for advanced materials and devices, and $15.0 million for technology development efforts to improve reliability of the entire system. The Department has included $4.5 million in the Fiscal Year 2006 request to support the new Collaborative Crystalline Silicon Photovoltaic Initiative designed to strengthen through research and development the technological competitiveness of U.S. products in a rapidly growing world market.

The $6.0 million request for concentrating solar power research includes funds to accelerate the development of next-generation parabolic trough concentrators and receivers. Development of advanced thermal energy storage technologies will continue and field validation will be conducted on new collector technology being deployed in trough projects in Arizona and Nevada. For distributed applications, research in Fiscal Year 2006 will focus on improving the reliability of dish systems through the operation and testing of multiple units at Sandia National Laboratory. Technical support will also be provided to the Western Governors' Association to assist their CSP deployment activities.

WIND AND HYDROPOWER TECHNOLOGIES

Wind Energy research and development promotes greater use of the Nation's fastest growing energy resource. Since 2000, installed wind turbine capacity in the United States has more than doubled, driven in large part by the tremendous reductions in cost that have resulted from wind energy research. Our research contributed to reducing the cost of electricity generation by a factor of 20 since 1982, to four cents or less per kilowatt-hour in areas with excellent wind resources.

The Fiscal Year 2006 Budget Request for Wind Energy is $44.2 million, $3.4 million more than the Fiscal Year 2005 comparable appropriation. Most of the Fiscal Year 2006 request is to fund R&D on multiple large wind system technology pathways in lower wind speed areas to achieve the goal of three cents per kilowatt-hour for onshore systems and five cents per kilowatt-hour for off-shore systems by 2012. Working in collaborative partnerships with industry, the Department plans to complete field testing of the first full-scale Low Wind Speed Technology prototype turbine in Fiscal Year 2006, and begin fabrication of a second prototype turbine (both 2.5 MW scale) which will enable electricity to be generated closer to where people live.

Hydropower is the most widely used form of renewable energy in the world today, accounting for over seven percent of total electricity generation in the United States and over 75 percent of domestic renewable electricity generation. The Department has supported the development of new turbine technology that reduces fish mortality associated with hydropower plant operation. With the completion of testing on new turbine technologies, and consistent with previous Congressional direction, the Department plans to close out the Hydropower Program and transfer remaining program activities and information to the private sector.

The Fiscal Year 2006 hydropower request of $0.5 million will be used to complete the monitoring of plant operation and maintenance, and document previous program activities. Outstanding contracts will be closed out in Fiscal Year 2006.

GEOTHERMAL TECHNOLOGY

The Geothermal Technologies Program works in partnership with industry to establish geothermal energy as an economically competitive contributor to the U.S. energy supply.

Currently a $1.3 billion a year industry, geothermal energy production generates electricity or provides heat for applications such as aquaculture, crop drying, and district heating, or for use in heat pumps to heat and cool buildings without the emission of greenhouse gases. The Fiscal Year 2006 Budget Request for Geothermal Technologies is $23.3 million, a $2.0 million decrease from the Fiscal Year 2005 comparable appropriation. The Fiscal Year 2005 appropriation included $3.6 million in funds for congressionally-directed activities now completed.

In Fiscal Year 2006, the program will conduct extensive field tests of exploration technologies such as remote sensing techniques to increase the U.S. geothermal re-

source base, and expand and accelerate the geothermal resource assessments conducted in collaboration with the U.S. Geological Survey. The program will continue its Enhanced Geothermal Systems (EGS) technology research to increase the productivity and lifetime of engineered reservoirs. The Department estimates that EGS technology could quadruple the amount of economically and technically viable geothermal resources in the West and open up new geothermal possibilities throughout the U.S.

BIOMASS AND BIOREFINERY SYSTEMS R&D

EERE's Biomass Program focuses on advanced technologies to transform the Nation's domestic biomass resources into high value fuels, chemicals, materials, and power. Working with the U.S. Department of Agriculture (USDA), the program leads a multi-agency initiative that coordinates and accelerates all federal bioenergy R&D in accordance with the *Biomass Research and Development Act of 2000.*

In Fiscal Year 2006, the Department is requesting $72.2 million for Biomass Program activities, $15.9 million less than the Fiscal Year 2005 comparable appropriation. Last year's appropriation, however, included $35.3 million in funds for congressionally-directed activities for which the Department is not requesting additional funds.

The Department requests $43.4 million to support platforms R&D. The $15 million request for Thermochemical Platform R&D will focus on developing technologies for the production, cleanup, and conditioning of biomass syngas and pyrolysis oils suitable for conversion to fuels and chemicals. This will be done in collaboration with industrial partners selected under a joint DOE/USDA solicitation issued in Fiscal Year 2004. The $28.4 million requested for Bioconversion Platform R&D is to work with industry to improve the performance and reduce the costs of enzymes and biomass pretreatment, resulting in a low cost sugar stream in support of the nearerterm biorefinery.

The request also includes $21.8 million for cost-shared R&D with U.S. industry to advance technologies that will convert this low cost sugar stream into affordable products (chemicals and materials), furthering the development of efficient biorefineries. Work with industry, universities, and the National Laboratories will focus on improving the efficiency of individual process steps such as catalysis and separations, with a focus on producing key building-block chemicals that have the potential to result in a multitude of high-value, renewable chemicals and materials.

WEATHERIZATION AND INTERGOVERNMENTAL PROGRAMS[2]

In Fiscal Year 2006, we are requesting $310.1 million for Weatherization and Intergovernmental Activities, a $15.7 million reduction from the Fiscal Year 2005 comparable appropriation. This includes $230 million for the Weatherization Assistance Program, which will support weatherization of approximately 92,300 low-income homes, saving the low-income homeowner an average of $274 annually on their energy bills at today's prices, according to estimates by the Oak Ridge National Laboratory.

The Department's Intergovernmental activities promote rapid deployment of clean energy technologies and energy efficient products. The Fiscal Year 2006 Budget requests $41.0 million for State Energy Program grants. These grants, and the funds they leverage, allow State governments to target their own high priority energy needs and expand clean energy choices for their citizens and businesses.

In Fiscal Year 2006, we request $4.0 million for the Tribal Energy Program which will enable the Department to continue to build partnerships with Tribal governments to assess Native American energy efficiency needs and renewable energy opportunities for residential, commercial, and industrial uses. These activities are helping to complete the foundational work that will encourage private sector investment in energy projects on Native American lands.

The Department includes an increase of $1.7 million in its Fiscal Year 2006 request to expand and support Home Performance with ENERGY STAR®, an innovative residential program designed to improve the energy efficiency of existing homes by up to 30 percent using certified local contractors to perform whole-house retrofits. State and local pilot projects will be supported at the national level by the dissemination of best practices, contractor training, program design assistance, and marketing support.

DISTRIBUTED ENERGY RESOURCES

By producing electricity where it is used, distributed energy technologies can strengthen our nation's aging electricity power infrastructure, relieve congestion on

[2] These programs are not R&D activities.

transmission and distribution systems, and increase supplies during periods of peak demand. The Distributed Energy Program seeks to develop and deploy a diverse array of integrated distributed generation and thermal energy technologies that are competitively priced, reliable, and highly efficient. The Fiscal Year 2006 Budget Request for this program is $56.6 million, a $3.8 million reduction from the Fiscal Year 2005 comparable appropriation. This funding level reflects the reallocation of funds given the advances made in previous years and changes within the overall energy research and development portfolio. As in previous years, this year's request emphasizes integrated designs for end-use systems.

Key performance target goals for Fiscal Year 2006 include the development of a combined heat and power (CHP) system which operates at over 70 percent efficiency and a prototype microturbine which can achieve 35 percent efficiency for small-scale power generation. To help potential users take better advantage of distributed energy opportunities, the program will complete a state regulatory database including information on regulations such as environmental permitting, utility tariffs, and interconnection standards, and continue funding the eight Regional Combined Heat and Power Application Centers across the United States.

BUILDING TECHNOLOGIES

With an annual price tag of over $250 billion, energy use by residential and commercial buildings accounts for nearly 40 percent of the Nation's total energy consumption, including two-thirds of the electricity sold in the United States. The $58 million included in this year's request for the Building Technologies Program is a decrease of $7.5 million from the Fiscal Year 2005 comparable appropriation, primarily due to reductions in space conditioning and building envelope R&D that is nearing commercialization. Fiscal Year 2006 activities include solid state lighting, improved energy efficiency of other building components and equipment, and their effective integration using whole-building-system-design techniques, and the development of codes and standards for buildings, appliances, and equipment.

The $18.3 million request for Residential Buildings Integration aims to develop design packages that enable residential buildings to use 40 to 50 percent less energy than current practice, and integrate renewable energy systems into highly efficient building designs and operations in working toward the ultimate goal in 2020 of net Zero Energy Buildings: houses that produce as much energy as they use on an annual basis.

As part of the Department's focus on longer-term, high-risk activities with great potential for public benefit, in Fiscal Year 2006 we are requesting $11 million for solid state lighting research. Solid state lighting holds the potential to more than double the efficiency of general lighting systems, revolutionizing the energy efficiency, appearance, visual comfort, and quality of lighting products.

The Fiscal Year 2006 request also reflects the Department's continued commitment to advancing buildings codes and appliance standards. Because key analyses and peer reviews for several priority appliance rule-makings will be completed in Fiscal Year 2005, funding requirements for Fiscal Year 2006 will be reduced in this area.

FEDERAL ENERGY MANAGEMENT PROGRAM

The Federal Energy Management Program (FEMP) and the Departmental Energy Management Program (DEMP) assist federal agencies and the Department in increasing their use of energy efficiency and renewable energy technologies through alternative financing contract support, technical assistance, and funding for retrofit projects. By using existing energy efficiency and renewable energy technologies and techniques, the Federal Government can set an example and lead the Nation toward becoming a cleaner, more efficient energy consumer.

FEMP's Fiscal Year 2006 request is $19.2 million, a $0.7 million reduction from the Fiscal Year 2005 comparable appropriation. We are requesting $6.8 million for FEMP technical support that promotes agency use of alternative financing tools, which allow federal agencies to access private sector financing to fund energy improvements through Energy Savings Performance Contracts (ESPC) and Utility Energy Service Contracts (UESC) at no net cost to taxpayers. In addition, we are requesting $7.7 million for Technical Guidance and Assistance activities to help federal energy managers identify, design, and implement new construction and facility improvement projects that incorporate energy efficiency and renewable energy.

INDUSTRIAL TECHNOLOGIES

The Industrial Technologies Program seeks to reduce the energy intensity of the U.S. industrial sector through a coordinated program of R&D, validation, and dissemination of energy-efficiency technologies and operating practices. The Depart-

ment is working to achieve the program's goals by partnering with domestic industry, its equipment manufacturers, and its many stakeholders.

The Fiscal Year 2006 Budget Request is $56.5 million, an $18.3 reduction from the Fiscal Year 2005 comparable appropriation. We strongly believe that this level of funding is sufficient because the Industrial Technologies Program is becoming more focused and more strategic in its investments in next-generation industrial technologies. The Program's strategic approach is based on developing a focused, multi-year plan that is designed to identify a limited number of high-priority, energy-saving research and development opportunities, characterize the technical barriers associated with each of those opportunities, and implement a multi-year development pathway to achieve success in each identified focus area. Many of these R&D efforts will be in exploratory phases in Fiscal Year 2006 as the program identifies the most promising technology areas and adopts a balanced portfolio of high-risk, high-return R&D.

PROGRAM MANAGEMENT AND DIRECTION

The Program Management (Energy Conservation) and Program Direction (Energy Supply) budgets provide resources for executive and technical direction and oversight required for the implementation of EERE programs. The Budget Request covers federal staff as well as the equipment, supplies, materials, information systems, technology equipment, and travel required to support management and oversight of programs. Also funded by this request are properties; public information activities; support service contractors; and crosscutting performance evaluation, analysis and planning.

The Fiscal Year 2006 Budget Requests for Program Management and Program Direction total $108.1 million, representing a $4.0 million (3.6 percent) decrease from the Fiscal Year 2005 comparable appropriations. The decrease primarily reflects completion of the National Academy of Science review, the absence of support for prior congressionally-directed activities, and the movement of support service funding for the Climate Change Technology Program out of this request. With these activities excluded, our request actually represents an increase of $4.9 million to support our efforts to improve project management and to more accurately report our true cost of doing business. We also request $2.9 million within Renewable Program Support for crosscutting analysis and planning, which was formerly funded within individual renewable program budgets.

CONCLUSION

Madam Chairman, we believe the Administration's Fiscal Year 2006 Budget for energy efficiency, renewable energy, and hydrogen research, development, demonstration and deployment programs will contribute to improved energy security by promoting a diverse supply of reliable, affordable, and environmentally sound energy, and by promoting the efficient use of energy.

This completes my prepared statement, and I am happy to answer any questions the Subcommittee may have.

BIOGRAPHY FOR DOUGLAS L. FAULKNER

Douglas Faulkner was appointed by President George W. Bush on June 29, 2001, to serve as the political deputy in the Office of Energy Efficiency and Renewable Energy (EERE). This $1.2 billion research and development organization has over five hundred federal employees in Washington, D.C. and six regional offices, supported by thousands of contractors at the National Renewable Energy Laboratory and elsewhere.

Mr. Faulkner oversees all aspects of EERE's operations in a close partnership with the Office's two career Deputy Assistant Secretaries. He has worked closely with Assistant Secretary David K. Garman to reorganize EERE, replacing an outdated and fragmented organization with what arguably is the most innovative business model ever used in the Federal Government. This has resulted in fewer management layers, fewer but more productive staff, streamlined procedures, stronger project management in the field and lower operating costs overall. These reforms have been recognized as a success by the White House and the National Association of Public Administration.

Mr. Faulkner organized and led an internal management board which completely revamped EERE's biomass programs. Many projects were ended and those funds pooled for an unprecedented solicitation to refocus R&D for new bio-refineries.

Interviews of Mr. Faulkner about renewable energy and energy efficiency have appeared on television and radio and in the print media.

Before assuming his leadership post in EERE, Mr. Faulkner had progressed rapidly through the ranks of the civil service at the Central Intelligence Agency and the Department of Energy. In his over twenty-year career he rose from junior China intelligence analyst to a nationally-recognized leader in bio-based products and a senior policy advisor to the Secretaries of Energy in both Bush Administrations.

Born and raised in central Illinois, Principal Deputy Faulkner received a Bachelor's degree in Asian Studies from the University of Illinois and a Master's degree from the Johns Hopkins University, School of Advanced International Studies. He also attended the University of Singapore as a Rotary Scholar. At these institutions, he studied French and Mandarin Chinese languages. Mr. Faulkner played intercollegiate basketball at home and abroad.

He is involved in his church and community as well as Boy Scouts and youth baseball. Mr. Faulkner was appointed in the early 1990s to two Arlington County, Virginia, economic commissions.

Mr. Faulkner lives in Arlington, Virginia, with his wife and son.

Chairwoman BIGGERT. Thank you.

I think we will have time for one more statement.

Mr. Maddox. Turn on your microphone.

STATEMENT OF MR. MARK R. MADDOX, PRINCIPAL DEPUTY ASSISTANT SECRETARY FOR FOSSIL ENERGY, THE DEPARTMENT OF ENERGY, WASHINGTON, DC

Mr. MADDOX. Chairwoman Biggert, Members of the Subcommittee, it is a pleasure to join you today.

You have received my submitted testimony, which presents the Office of Fossil Energy's fiscal year 2006 request in detail.

I thought it would be useful this morning to survey briefly Fossil Energy's programs in order to provide you with a sense of what we have accomplished, what we are working on now, and what we expect to accomplish in the future.

Coal is the Nation's most abundant energy resource, with domestic reserves exceeding the energy potential of the world's total oil reserves. About 90 percent of all coal produced in the United States is used for electricity generation, and over half of our nation's electricity is produced by coal-fired plants.

Since 1970, the United States has reduced sulfur dioxide emissions from coal by 40 percent, nitrogen oxide emissions by more than 20 percent, and particulate emissions by 60 percent while tripling coal consumption. Building on this foundation, the Clean Coal program's overall goal is to continue to reduce polluting emissions, including mercury and greenhouse gas, to near zero by the year 2020. We expect to do this by developing technologies that increase efficiencies and, therefore, emit fewer pollutants, and by developing technologies that capture pollutants.

Let me highlight a few of the programs that will help us reach our goals and fulfill President Bush's 10-year, $2-billion commitment to clean coal research.

First, the Innovation for Existing Plants Program, which is designed to produce dramatic short-term reductions in emissions of nitrogen oxide, sulfur dioxide, particulate matter, mercury, and byproducts of combustion from existing plants. The 1970's federal research projects helped improve the ability of early scrubbers to remove sulfur from exhaust gases. The Energy Department's Clean Coal Technology program in the 1980s demonstrated lower costs and more effective scrubber technologies. To meet the more stringent and oxide standards in the 1990 Clean Air Act amendments, many power plants turned to new, low-nitrogen oxide burners pio-

neered by the Energy Department's Clean Coal Technology program.

The Innovations for Existing Plants Program is today completing tests of technologies that can reduce mercury by 50 to 70 percent, nitrogen oxide to less than 0.15 pounds per million BTUs at three-fourths the cost of selected catalytic reduction, particulate matter by 99.99 percent, and acid gases by 95 percent. By 2010, the program expects to test technologies for advanced cooling, 90 percent mercury reduction and a 66 percent increase in byproducts use.

- The proven Integrated Gasification Combined Cycle, or IGCC, technology is designed to deliver significant increases in operating efficiency and reductions in emissions when compared to conventional coal-based plants. Our strategy is to make IGCC technology more efficient and flexible, cleaner, and cheaper.
- The Clean Coal Power Initiative, or CCPI, is devoted to the rapid demonstration of emerging technologies in coal-based power generation and the acceleration of commercialization. To date, CCPI projects include an array of new, cleaner, and cheaper concepts for reducing sulfur dioxide, nitrogen oxides, and mercury, as well as two next-generation IGCC projects. CCPI also includes the power plant of the future, FutureGen.
- Carbon sequestration, the capture and permanent storage of carbon dioxide, has emerged as an extremely promising technology. The program includes regional partnerships throughout the United States and parts of Canada to identify best locations and appropriate technologies.
- The Fuels program includes production of Hydrogen from Coal. Hydrogen's energy potential has become more apparent, not just for transportation, but as a clean fuel for advanced power technologies, such as fuel cells for stationary power generation.
- The Fuel Cell R&D program has been refined to focus on the successful and highly promising work of the Solid State Energy Conversion Alliance, known as SECA. Fuel cell technology for stationary electricity generation offers ultra-low, high operating efficiency and near zero polluting and greenhouse gas emissions.
- The mission of the Natural Gas Technology program has been to develop policies and new technologies that stimulate a diverse supply of natural gas, both in North America and around the world. The Oil Technology program's mission has been to implement a policy and research and development program to resolve the environmental supply and reliability constraints of producing oil resources.

Budget discipline necessitated and close scrutiny of our oil and natural gas technology programs using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. As a result, the budget proposes to conduct the orderly termination of the Oil and Gas Technology program in Fiscal Year 2006, with prior year funds used to support ongoing projects.

Finally, the Strategic Petroleum Reserve, an energy security mainstay of the Nation, continues to operate smoothly as we work toward filling the reserve to 700 million barrels this year.

Chairman Biggert and Members of the Subcommittee, I look forward to your questions.

[The prepared statement of Mr. Maddox follows:]

PREPARED STATEMENT OF MARK R. MADDOX

Chairman Biggert, Members of the Committee, it is a pleasure to join you today to present the Office of Fossil Energy's FY 2006 budget submission. The Department appreciates the support of the Chairman and the Members of the Committee over the past years and looks forward to working with you on budget issues related to the Fossil Energy Program.

Before I discuss the Fossil Energy budget in detail, I would like to say that in his February 2, 2005 State of the Union Address, the President underscored the need to restrain spending in order to sustain our economic prosperity. As part of this restraint, it is important that total discretionary and non-security spending be held to levels proposed in the FY 2006 President's Budget.

The budget savings and reforms in the Budget are important components of achieving the President's goal of cutting the budget deficit in half by 2009 and we urge the Congress to support these reforms. The FY 2006 President's Budget includes more than 150 reductions, reforms, and terminations in non-defense discretionary programs, of which two program terminations are reflected in the Department's Fossil Energy budget. Those program terminations are for the Natural Gas and Oil Technology programs. The Department wants to work with the Congress to achieve these savings.

The Office of Fossil Energy

At the core of the Department's mission are two fundamental objectives: to ensure America's readiness to respond to short-term energy supply disruptions and to provide the Nation with the best opportunity to tap the full potential of its abundant fossil fuel resources.

As the Nation strives to reduce its reliance on imported energy sources, DOE is leading the way by seeking new energy technologies and methodologies that promote the efficient and environmentally sound use of fossil fuels.

The United States relies on fossil fuels for about 85 percent of the energy it consumes and forecasts indicate U.S. reliance on these fuels could exceed 87 percent by 2025.

Accordingly, a key goal of DOE's fossil energy activities is to ensure that economic benefits from fossil fuels are compatible with the public's expectation for exceptional environmental quality and reduced energy security risks. This includes promoting the development of energy systems and practices that will provide current and future generations with energy that is clean, efficient, reasonably priced, and reliable.

The Department's programs focus on supporting the President's top initiatives for energy security, clean air, climate change, and coal research. FY 2006 DOE programs:

- Support the development of lower cost, more effective pollution control technologies embodied in the President's Coal Research Initiative to meet the goals of the President's Clear Skies Initiative;
- Expand the Nation's technological options for reducing greenhouse gases either by increasing power plant efficiencies or by capturing and isolating these gases from the atmosphere; and
- Measurably add to our energy security by providing a series of solutions to the Nation's energy challenges, beginning with the short-term emergency response provided by such programs as the Strategic Petroleum Reserve. Long-term responses to the energy security challenge include the production of hydrogen from coal to support and hasten development of the "hydrogen energy economy."

The President's Coal Research Initiative

Coal is our nation's most abundant energy resource, with domestic reserves almost equal to the energy potential of the world's total oil reserves. About 90 percent of all coal produced in the United States is used for electricity generation, and over half of our nation's electricity is produced by coal-fired power plants.

Meeting rising demand for clean, reliable and affordable electricity will require the use of coal for the foreseeable future, which in turn will require the development of new, environmentally sound technologies for coal-based electricity generation.

The FY 2006 budget supports the Department's continuing effort to fulfill President Bush's 10-year, $2 billion commitment to clean coal research, beginning with funding for the President's Coal Research Initiative (CRI) of $286 million, a $13 million increase over the 2005 enacted level.

In addition to increasing funding for CRI, the distribution of funds to various research and development components of the program has been modified to achieve the maximum program benefit in a disciplined budget environment through improved alignment with the Research and Development Investment Criteria.

Clean Coal Power Initiative and FutureGen

Within the President's Coal Research Initiative, the Clean Coal Power Initiative (CCPI) is a key component of the National Energy Policy to address the reliability and affordability of the Nation's electricity supply, particularly from its coal-based generation. The FY 2006 budget request includes $68 million for CCPI, $50 million of which is for demonstration projects, and $18 million for FutureGen, the world's first near-zero emissions coal-fueled power plant.

The $50 million allocated for the cooperative, cost-shared CCPI program between government and industry will be devoted to continuing the rapid demonstration of emerging technologies in coal-based power generation, which should accelerate commercialization by the private sector. Under CCPI, the Nation's power generators, equipment manufacturers, and coal producers help identify the most critical barriers to coal's use in the power sector. Technologies are selected with the goal of accelerating development and enhancing the potential for deployment of coal technologies that will economically meet environmental standards, while increasing the efficiency and reliability of coal power plants.

There are currently 10 active CCPI projects, six from the first competition, announced in January 2003, and four from the second, announced in October 2004. The projects have a total value of $2.7 billion, $550 million of which is the Department of Energy's cost share. The projects include an array of new cleaner and cheaper concepts for reducing sulfur dioxide, nitrogen oxides, and mercury—the three air pollutants targeted by the Clear Skies Initiative.

In FY 2006, the Department will begin developing a solicitation for a third round of projects.

The FutureGen program for FY 2006, backed up by a request for $257 million to become available in FY 2007 that corresponds to unexpended funds available from prior years' clean coal projects, will establish the capability and feasibility of co-producing electricity and hydrogen from coal with essentially zero emissions, including carbon sequestration and gasification combined cycle, both integral components of the coal-fueled power plant of the future. FutureGen is important to demonstrating the future of coal use to meet the Nation's energy security and environmental challenges.

The FY 2006 Budget Request also includes $283 million for research and development programs in the President's Coal Research Initiative and Distributed Generation Systems, with an emphasis on advanced technologies that support the FutureGen vision of coal-fueled generation of electricity and hydrogen with essentially zero emissions. The programs will focus on all the key technologies for FutureGen: carbon sequestration, membrane technologies for oxygen and hydrogen separation, advanced turbines, fuel cells, coal to hydrogen conversion, gasifier related technologies, and other technologies.

Carbon Management

Several Clean Coal projects help to increase the available options for meeting the President's climate change goal of an 18 percent reduction in greenhouse gas intensity (carbon equivalent per GDP) by 2012, primarily by boosting the efficiencies of power plants—the less fuel used to generate electricity, the lower the emissions of greenhouse gases.

Carbon management has become an increasingly important element of our coal research program. Carbon sequestration—the capture and permanent storage of carbon dioxide—has emerged as one of the highest priorities in the Fossil Energy research program—a priority reflected in the proposed budget of $67.2 million in FY 2006, a nearly 50 percent increase over FY 2005's $45 million allocation.

One of the cornerstones of our carbon sequestration program, a national network of regional partnerships, will continue its important work in FY 2006. This Secretarial initiative has brought together the Federal Government, state agencies, uni-

versities, and private industry to determine which options for capturing and storing greenhouse gases are most practicable for specific areas of the country.

In addition, the international, Ministerial-level Carbon Sequestration Leadership Forum will continue to execute its mission of gathering data, exchanging information and participating in joint projects to advance carbon sequestration technology.

Hydrogen

Another aspect of the President's Coal Research Initiative is the production of hydrogen from coal. Hydrogen production research is important because hydrogen can serve as a clean fuel for tomorrow's advanced power technologies such as fuel cells for distributed generation, and for future transportation systems. Within the Fossil Energy program, we are requesting $22 million in FY 2006 for hydrogen-from-coal research, a 27 percent increase over the FY 2005 appropriation of $17 million.

Innovations for Existing Plants

While DOE continues its aggressive Research, Development and Demonstration projects for technologies of the future, it is also supporting the President's Clear Skies Initiative with short-term advanced for current technology. Innovations for Existing Plants is an important program that aims to achieve dramatic reductions in emissions of mercury, nitrogen oxide, particulate matter and byproducts of combustion from existing coal plants. We are requesting $24 million in FY 2006, a 25 percent boost over the FY 2005 appropriated level of $19 million.

Gasification Technology (Integrated Gasification Combined Cycle)

Advances to the leading edge integrated gasification combined cycle (IGCC) technology, which delivers significant increases in operating efficiency and reductions in emissions when compared to conventional coal-fired power plants, will intensify in FY 2006 with R&D projects aimed at reducing capital costs and technical risk, increasing plant efficiency and availability, and achieving essentially zero emissions. We are requesting $56 million for Gasification Technology in FY 2006 to improve and test gasification designs, materials, instrumentation and processes. This represents a 23 percent increase over the FY 2005 appropriation of $46 million.

Fuel Cells

Perhaps better known to the public for its potential to power automobiles, fuel cell technology also presents enormous potential to significantly improve environmental performance and energy security as a source of electrical power in stationary plants at or near the end user. Fuel cells are highly adaptable; they can be sued as a stand-alone power source, integrated with other generators, or connected to a central power grid.

Fuel cells can reduce criteria pollutants well below New Source Performance Standard levels, as well as thermal and acid rain precursor emissions. They offer important carbon management advantages because of their inherently low emissions and ultra-high operating efficiency.

In distributed generation systems, fuel cells can help meet peak demand requirements cost-effectively, and IGCC and FutureGen systems with fuel cell modules have the potential to significantly increase the efficiency of coal-based systems and achieve near-zero emissions.

Finally, fuel cells will be a vital element in the hydrogen economy of the future, using hydrogen from coal to both generate electric power and support the hydrogen fuel cell-powered automotive fleet envisioned in President Bush's FreedomCAR and Hydrogen Fuel initiatives.

Faced with these potential benefits the Department has refined its ongoing Fuel Cell Research and Development program to focus on the successful and highly promising work of the Solid State Energy Conversion Alliance (SECA). To better align the program with the R&D Investment Criteria, all fuel cell funding for FY 2006 has been redirected to SECA from previous, less promising or completed R&D projects that ran in parallel with the SECA program.

This decision provides a two-fold budgeting benefit: the overall cost of the fuel cell program would be reduced by $10 million, to $65 million in FY 2006, while funding for the most promising research avenue, SECA, increases by nearly $12 million, or 20 percent, over the FY 2005 appropriation of $54 million.

In a disciplined bud get environment, DOE has fashioned a Clean Coal program that answers the short-, mid- and long-term energy and environmental challenges of the Nation by effectively allocating resources to balance work on today's demonstration projects with research and development into tomorrow's technologies and, ultimately of FutureGen, the power plant of the future.

Oil and Natural Gas Technology

The FY 2006 budget request includes $20 million for the cost of orderly termination of the Oil and Gas technology programs, with prior-year funds to be used for the purposes appropriated. The decision to terminate these programs reflects a strategic assessment of the programs' technical effectiveness compared to other fossil energy programs that are more efficient and technically viable. This is in line with our commitment to deliver results for the American taxpayer. The focus in FY 2006 will be to conduct the orderly termination of these programs and I look forward to achieving this efficiency for the taxpayers. Funding requested in the FY 2006 budget will be used to fulfill legal obligations incurred in the termination process.

Other Fossil Energy Research and Development Activities

The budget request also includes $120 million for other activities in the Fossil Energy Research and Development program, including $99 million for headquarters and field office program direction and management support; $8 million for environmental restoration; $3 million for federal matching funds for cooperative research and development projects; $1.8 million for natural gas import/export responsibilities; and $8 million for advanced metallurgical research at the Albany Research Center.

Strategic Petroleum Reserve (SPR)

The President has directed that the Strategic Petroleum Reserve (SPR) be filled to 700 million barrels. The mechanism for doing this is a cooperative effort with the Minerals Management Service to transfer to SPR exchange royalty oil from federal leases in the Gulf of Mexico. Current projections are that SPR will reach its 700 million barrel target in mid-2005.

The FY 2006 budget request for SPR facilities development and management is $166 million, approximately equal to the FY 2005 budget appropriation. The SPR does not require additional funds in the oil acquisition account for transporting "royalty-in-kind" oil to the SPR, since these charges are the responsibility of the oil supplier. Also, SPR has the authority to "borrow" funds from other Departmental accounts to support an emergency SPR drawdown.

Northeast Home Heating Oil Reserve

FY 2006 activities for the Heating Oil Reserve will be funded with carryover from prior years. The two million barrel reserve remains ready to respond to a Presidential Order should there be a severe fuel oil supply disruption in the Northeast.

Naval Petroleum and Oil Shale Reserves

The FY 2006 Budget Request of $18.5 million funds environmental remediation, cultural resource, and equity determination activities required as a result of the Naval Petroleum Reserve No. 1 sales agreement. Also included is continued operation of the Rocky Mountain Oilfield Testing Center (RMOTC), the Naval Petroleum Reserve No. 3 in Wyoming, and lease management activities at Naval Petroleum Reserve No. 2.

Elk Hills School Lands Fund

The National Defense Authorization Act for FY 1996 required, subject to appropriation, DOE to pay nine percent of the net proceeds of the Elk Hills sale to the Teachers Retirement Fund of the State of California with respect to its longstanding claims to two parcels of land ("school lands") within NPR–1. The $84 million budget for Elk Hills in FY 2006 reflects the advance appropriation of $36 million included in the FY 2005 Interior Appropriations Act and additional funds for a seventh payment. In light of the delays in equity finalization, discussions are ongoing.

Closing

Fossil Energy's programs are structured to promote the cost-effective development of energy systems and practices that will provide current and future generations with energy that is clean, efficient, reasonably priced, and reliable. Our focus is on supporting the President's top initiatives for energy security, clean air, climate change, and coal research. By reevaluating, refining and refocusing our programs and funding the most cost-effective and beneficial projects, the FY 2006 budget submission meets the Nation's critical needs for energy, environmental and national security.

Chairman Biggert, and Members of the Committee, this completes my prepared statement. I would be happy to answer any questions you may have at this time.

BIOGRAPHY FOR MARK R. MADDOX

Mark Maddox currently serves as the Principal Deputy Assistant Secretary in the Office of Fossil Energy. In this position, Mr. Maddox is involved in several high-priority Presidential initiatives including implementation of the Administration's $2-billion, 10-year initiative to develop a new generation of environmentally sound clean coal technologies, the $1-billion FutureGen project to develop a pollution-free plant to co-produce electricity and hydrogen, and the Nation's Strategic Petroleum Reserve and Northeast Home Heating Oil Reserve, both key emergency response tools available to the President to protect Americans from energy supply disruptions.

Prior to taking his position in Fossil Energy in September 2003, Mr. Maddox served as a Senior Policy Advisor to the Secretary of Energy Spencer Abraham, where he was responsible for advising on fossil energy and environmental management program issues, as well as on communications strategy. He continues to serve as the government co-chair for the National Petroleum Council's Gas Study Group's Demand Task Force and its Transportation and Distribution Task Force.

During 1989–1993, Mr. Maddox was Deputy Director of Public Affairs at Department of Energy, where he helped design and implement the strategic communication plan for the Persian Gulf War, directed the Department's crisis communications planning, and supervised the public affairs activities of its field sites.

Prior to returning to public service in 2002, Mr. Maddox was Director of Communications and public affairs for the IMS division of Lockheed Martin, Inc., now Affiliated Computer Services State and Local Solutions, Inc. In these roles, he participated in developing the division's political and legislative strategies, served as spokesman, and developed the division's communications strategies. Before joining Lockheed Martin, Mr. Maddox was Vice President for a mid-size Washington, D.C., public relations firm where he represented clients on a variety of issues.

He has served as the Chief of Staff to a Member of the U.S. House Commerce Committee, where he was active on telecommunications, electricity deregulation and other issues under Committee jurisdiction. He has also worked as a Press Secretary in Congress and local government.

Mr. Maddox holds an MBA from George Washington University and a Bachelor of Science in Journalism from Bowling Green State University in Ohio. An Ohio native, he resides in Alexandria, VA, with his wife and two children.

Chairwoman BIGGERT. Thank you very much.

There are six minutes left in this vote. I think that we will recess at this time and probably come back about 11:05 or after or so. You have time to get a cup of coffee and relax for a few minutes, and we will come back then.

Thank you very much.

The Committee stands in recess.

[Recess.]

Chairwoman BIGGERT. The Committee will be in order, and we will move on to our next witness.

Mr. Johnson, you are recognized for five minutes.

STATEMENT OF MR. ROBERT SHANE JOHNSON, DEPUTY DIRECTOR FOR TECHNOLOGY, THE OFFICE OF NUCLEAR ENERGY, SCIENCE, AND TECHNOLOGY, THE DEPARTMENT OF ENERGY, WASHINGTON, DC

Mr. JOHNSON. Chairman Biggert, Members of the Subcommittee, it is a pleasure to be here to discuss the Fiscal Year 2006 budget submission for the Department's Office of Nuclear Energy, Science, and Technology.

Our request details proposed programs totaling $511 million to continue our efforts to develop and deploy advanced nuclear energy technologies in this country.

I have submitted a written statement for the record, but would like to provide a few summary remarks.

In Fiscal Year 1998, the Nation's Nuclear Energy Research program had come to a virtual standstill. In that year, federal funding for Nuclear Energy R&D fell essentially to zero. It was also a year when the number of students entering the nuclear engineering discipline in this country plummeted from around 1,500 only five years earlier to an all-time low of about 500. It was a year when the international community began to turn away from the United States as a source of leadership in nuclear technology development.

Since that time, the Chair and Members of this subcommittee have invested considerable personal effort to shepherd a revival of the Federal Nuclear Energy Research program. Similarly, we at the Department have worked hard to refocus and re-invent our efforts to create a better, stronger program.

I am pleased to report that these efforts are proving to be successful. Nuclear engineering education is resurgent in the United States with nearly 1,600 students now studying in the schools across our country. The number of students studying nuclear science has such an increase; strong programs at universities, such as Ohio State, Purdue, and Texas A&M continue to grow; and we see new programs being established in schools, such as South Carolina State University and the University of Nevada, Las Vegas.

The Department's programs, aimed at enhancing nuclear education in the United States, continue to support this progress in our 2006 budget request. We have reasserted U.S. leadership in the international community. In February of this year, Secretary Bodman joined the ambassadors and senior officials from France, the United Kingdom, Japan, and Canada in signing the world's first, multi-lateral agreement for the development of next-generation nuclear energy technologies. As this Generation IV agreement and other actions demonstrate, the United States is once again setting the pace for international cooperation and partnership.

The Generation IV technologies emerging from this work will not only be safe, economic, and secure, but will also include energy conversion systems that produce valuable commodities, such as hydrogen, fresh water, and process heat. These features make the Generation IV reactors ideal for meeting the President's energy and environmental objectives.

At the same time, our partners in industry have worked hard to improve the picture on their side. When it appeared that nuclear power's era had ended in the United States, nuclear utilities turned their operations around, focusing on management excellence and safety, making more nuclear-generated electricity than at any time in history. Through improvements in operation, U.S. utilities have added the equivalent of 25 new nuclear plants to the U.S. grid since 1990 without building any new plants. U.S. utilities are working with us and others to explore the construction of new U.S. nuclear plants for the first time in decades.

Madame Chairman, I have no doubt that our work under the Nuclear Power 2010 program has contributed to these positive developments. Through this effort, we have helped to organize industry to take the next vital steps toward the next U.S. nuclear power plant.

Finally, Madame Chairman, I would like to note that in February, we also successfully launched the new Idaho National Lab-

oratory. The development of this new laboratory is an essential step in furthering our nuclear energy research agenda. We now, like the other DOE programs represented here today, have a core laboratory that can serve as our command center for our program's key research efforts. This new lab, working closely with other key National Laboratories, industry, academia, and the international community, will help us to implement an exciting, world-changing agenda aimed at delivering new energy technologies that will foster economic growth and a healthier environment for generations to come.

I conclude my remarks, Madame Chairman, by thanking you for your leadership and partnership with us in this endeavor.

Thank you. I look forward to your questions.

[The prepared statement of Mr. Johnson follows:]

PREPARED STATEMENT OF ROBERT SHANE JOHNSON

Chairman Biggert, Representative Honda, and Members of the Subcommittee, it is a pleasure to be here to discuss the Fiscal Year (FY) 2006 budget submission for DOE's Office of Nuclear Energy, Science and Technology.

In his February 2nd State of the Union Address, the President underscored the need to restrain spending in order to sustain our economic prosperity. As part of this restraint, it is important that total discretionary and non-security spending be held to levels proposed in the FY 2006 Budget. The budget savings and reforms in the Budget are important components of achieving the President's goal of cutting the budget deficit in half by 2009 and we urge the Congress to support these reforms. The FY 2006 Budget includes more than 150 reductions, reforms, and terminations in non-defense discretionary programs, of which six affect Department of Energy programs. The Department wants to work with the Congress to achieve these savings.

Of these six programs, two programs are from the Office of Nuclear Energy, Science and Technology: the Nuclear Energy Plant Optimization (NEPO) and the Nuclear Energy Research Initiative (NERI) programs. Research conducted under the NEPO program is designed to assure the ability of currently operating nuclear power plants to remain in service up to and beyond their licensed operating period. No funding is requested for the NEPO program in FY 2006 because industry is committed to continuing the research begun under NEPO without DOE support, allowing DOE to focus on higher priority activities. No stand-alone funding is requested for the NERI program as the Department's principal nuclear energy research and development (R&D) programs (Generation IV Nuclear Energy Systems Initiative, Advanced Fuel Cycle Initiative, and Nuclear Hydrogen Initiative) will be sponsoring NERI research projects within the Nation's university research community to enhance the research cooperation between academia and our national laboratories and to strengthen our mainline R&D programs.

For most of our nation's history, America's vibrant economy and society have benefited from the abundant energy options we have had available. Even though we experienced oil price shocks in the 1970s and 1980s, the vast majority of the energy used in the United States is, even today, produced in the United States. Our coal, oil, natural gas, nuclear, and renewable resources all contribute to a diversified and reliable energy picture.

However, we are entering a new era in energy supply. As highlighted in the President's *National Energy Policy,* forecasts indicate that our need for energy—even with ambitious implementation of energy efficiency measures across all sectors of the economy—will continue to grow as our economy grows. The Energy Information Administration forecasts that by 2025, the United States will import 38 percent of all of its energy and 68 percent of its energy for transportation uses. Buried in these estimates is an ominous fact that has escaped casual notice—the U.S. will, over this period, begin a steadily increasing dependence on imports for fuels needed for electricity generation that may, over the coming decades, follow the patterns of our accelerating dependence on imports required for the transportation sector.

To meet these challenges while still assuring America's access to reliable baseload electricity—while setting a path toward reduced emissions—we must apply advanced technologies. New technology can help us to exploit renewable energy sources when they are practical, and enable coal to continue as a viable, long-term element of our energy supply. And as the President conveyed in his State of the

Union address, we must consider new nuclear energy as part of our long-term energy picture.

The Department of Energy's nuclear energy program has made significant progress over the past several years. From the time, not so many years ago, when it appeared that the United States might abandon advanced nuclear research and development, we have been successful in reasserting U.S. leadership in this area around the world. Representing the United States, I have been elected by my international colleagues to serve as the chair of two important international bodies—the Organization of Economic Cooperation and Development Steering Committee on Nuclear Energy and the Generation IV International Forum.

We continue to build on our leadership. Just a few weeks ago, we celebrated the launch of the Nation's central laboratory for nuclear research and development—the Idaho National Laboratory (INL). This new national laboratory combines the resources of the former Idaho National Engineering and Environmental Laboratory (INEEL) and the former Argonne National Laboratory-West (ANL–W). The INL will lead much of the Department's exploration into advanced nuclear reactor and fuel cycle technology. We have set an aggressive goal for the new INL to become the world's premier center for nuclear energy research and education within a decade.

Developing a central research laboratory is a major step forward for the nuclear energy program. We, like other key energy programs at the Department, have created a central, dedicated research site at which we can consolidate our infrastructure investments and build the expertise needed to accomplish our long-term program goals. A central lab also helps us minimize the shipment of nuclear materials across the country and allows us to bring our nuclear materials together in a single, secure location. In addition, we expect that our new central, dedicated research laboratory will become a major player in the education of the next generation of nuclear energy technologists that this nation will need to assure our energy security in the future.

The Department's FY 2006 request for the nuclear energy program proposes a $511 million (an increase of $25 million compared to FY 2005) investment in nuclear research, development, education and infrastructure for the Nation's future that is designed to continue this progress. This budget request demonstrates our commitment to support the President's priorities of enhancing the Nation's energy independence and security while limiting air pollution. Our request supports the development of new nuclear generation technologies and advanced energy products that will provide significant improvements in the economics, sustainability, safety and reliability of nuclear-based energy, as well as its resistance to proliferation and terrorism.

We are committed to efficiently managing the funds we are provided. We have abandoned outdated field office and laboratory management paradigms and have integrated the Idaho Operations Office with our headquarters organization, enabling us to closely manage our responsibilities in the field to achieve greater quality and efficiency. We are enhancing our expertise in critical areas such as project management through training and certification of existing staff and the acquisition of experienced, proven managers. We are also applying international and public-private partnerships in the implementation of our research and development programs as a way of leveraging our investments and assuring the utility of our programs. We believe these steps must be taken to assure our program's ability to make the best use of the taxpayer dollars.

While we have made great progress in all these areas, much remains to be done. Our FY 2006 request moves us in the right direction.

FISCAL YEAR 2006 BUDGET REQUEST

NUCLEAR POWER 2010

Today, American utilities operate 103 nuclear power plants. These facilities operate reliably and efficiently and provide a fifth of the Nation's electricity. These plants are emissions-free and can operate year-round in all weather conditions.

Over the last 15 years, nuclear utilities in the United States have been increasingly better managed, improving both efficiency and safety. In the early 1990s, U.S. plants were available to produce energy only 70 percent of the time on average. These plants are now producing power over 90 percent of the time. More efficient operation has allowed nuclear plant operators to produce more energy than ever before, adding the equivalent of 25 new nuclear plants to the U.S. grid since 1990 without building any new nuclear power plants.

Consolidation of nuclear plant ownership to a fewer number of excellent operators has made the operation of U.S. plants safer than ever, more cost-effective, and more reliable. Companies acquiring nuclear plants are the leaders in the nuclear industry with high marks in operating performance. These utilities bring newly acquired

plants the benefit of economies of scale, experienced staff, well-honed management processes. As a result of this success, essentially all U.S. nuclear plants are expected to apply for renewed licenses that will keep most plants in operation into the middle of the century. There will also be some new generation, with The Tennessee Valley Authority rebuilding a plant that ceased operating in 1985. TVA expects to invest $1.8 billion to bring a 1,065-megawatt plant on-line by 2007.

With renewed interest from industry, the Department is investing in the Nuclear Power 2010 Program. This program's basic missions are to cost-share with industry demonstration of new, untested Nuclear Regulatory Commission licensing processes, finding sites on which to build new plants, and certifying state-of-the-art (or "Generation III+") designs for new nuclear power plants. The program also conducts economic studies and analysis that help point to the barriers facing the construction of new plants.

While it is too early to determine success, this program appears to be on the right track. Three utilities are cooperating with the Department to obtain "Early Site Permits" for three sites across the country—the first time this important regulatory tool has ever been used. The Nuclear Regulatory Commission is currently reviewing the utilities' applications and is expected to issue these permits during FY 2006. Once done, these utilities will have sites that are pre-approved by regulators to host new plants. This process will avoid the problems in siting that vastly escalated the cost of some plants in the 1980s and led to the abandonment of others (most notably the Shoreham plant in New York).

In November 2004, the Nuclear Power 2010 program took its next major step by awarding two major projects to utility-led consortia to implement plans that could lead to the construction and operation of new U.S. nuclear plants. Central to this effort, these projects will demonstrate—again, for the first time—the Nuclear Regulatory Commission's combined Construction/Operating License (or "one-step" license) process. These projects could result in a new nuclear power plant order by 2009 and a new nuclear power plant constructed by the private sector and in operation by 2014.

In addition to regulatory barriers, it is also important to deal with the financial barriers facing new nuclear power plant projects. Under the Nuclear Power 2010 program, DOE sponsored an independent study by the University of Chicago's Department of Economics. This study found that the first few nuclear power plants built in the United States would be too costly for utilities to build because of early plant costs. These high initial costs arise because the United States has not built nuclear plants in a very long time—the resulting new design, construction, licensing, and financial uncertainties are reflected as higher costs. However, the study found that once these early plant costs are absorbed, new nuclear power plants may be less expensive to build and operate than either coal-based power plants or natural gas-fired plants.

The need to deal with these early plant costs is expected to become a central issue for the industry as the Nuclear Power 2010 program addresses the institutional barriers. Without the construction of new plants, the contribution of nuclear power as a percentage of the Nation's total energy mix will steadily decline. Supporting nuclear power helps to maintain a more diversified energy supply and, because it is emissions-free, will not contribute to air pollution—nuclear power today comprises almost 75 percent of all the non-emitting power generation in the country. The President's Budget supports continuation of the Nuclear Power 2010 initiative in FY 2006 with a request of $56 million (an increase of $6.4 million compared to FY 2005).

FISCAL YEAR 2006 BUDGET REQUEST

GENERATION IV NUCLEAR ENERGY SYSTEMS INITIATIVE

Our Generation IV effort continues to make significant progress. Since the Generation IV International Forum (GIF) and the Nuclear Energy Research Advisory Committee (NERAC) issued their joint report, *A Technology Roadmap for Generation IV Nuclear Energy Systems,* the members of the Forum have expanded to include Switzerland and the European Union. The now eleven members (Argentina, Brazil, Canada, the European Union, France, Japan, the Republic of Korea, the Republic of South Africa, Switzerland, the United Kingdom and the United States) have organized into interest groups associated with each of the six selected Generation IV.

A landmark international framework agreement for collaborative research and development among the GIF member countries was signed in Washington, D.C., by the United States and its GIF partners on February 28, 2005. *The Framework Agreement for International Collaboration on Research and Development of Generation IV Nuclear Energy Systems,* which has been under negotiation for the past year,

will allow the United States and its partner countries to embark on joint, cost-shared research and development of Generation IV nuclear energy systems. These next-generation nuclear technologies offer the potential for significant improvements in sustainability, proliferation resistance, physical protection, safety and economics. The agreement will further the development of advanced technologies that are widely acceptable; enable the Department to access the best expertise in the world to develop complex new technologies; and allow us to leverage our scarce nuclear R&D resources.

With this agreement in place, we are moving forward with these countries to develop advanced reactor technologies that could be made available in the 2020 to 2030 timeframe. Generation IV concepts offer significant improvements in the sustainability, proliferation resistance, physical protection, safety and economics of nuclear energy. These advanced systems will not only be safe, economic and secure, but will also include energy conversion systems that produce non-electricity products such as hydrogen, desalinated water and process heat. These features make Generation IV reactors ideal for meeting the President's energy and environmental objectives.

We will explore a range of Generation IV concepts, including the Supercritical Water-Cooled Reactor, the Gas-Cooled Fast Reactor and the Lead-Cooled Fast Reactor. Our efforts will focus on establishing technical and economic viability, and developing core and fuel designs, and advanced materials for these concepts. We request $45 million (an increase of $5.3 million compared to FY 2005) support our investigation of technical and economic challenges and risks, including waste products, to inform a decision on whether to proceed with a demonstration of the Next Generation Nuclear Plant (NGNP), which would use very high temperature reactor technologies to economically produce both electricity and hydrogen gas. The President's Budget supports advanced research into the systems, materials, and fuels that are needed to bring Generation IV concepts to fruition. Key to the strategy for conducting all Generation IV research and development is the multiplication effect derived from international collaboration. By coordinating U.S. efforts with those of the GIF partner nations, our funding is leveraged by a factor of two to ten, depending on the reactor concept involved.

We are also working in close cooperation with the Department's Office of Science through the "Materials for Advanced Energy Systems Initiative" to coordinate the research advanced materials for use in Generation IV nuclear energy systems, fusion energy systems, and advanced energy technologies such as hydrogen production systems. Through a joint working group, the offices are coordinating on energy materials related issues with the purpose of investigating materials behavior in high temperature, radiation, and hostile corrosive environments, as well as the fabrication and non-destructive evaluation or monitoring of such materials. As common projects are identified, the offices will work to establish research objectives and cooperative work plans to leverage research funding.

FISCAL YEAR 2006 BUDGET REQUEST

NUCLEAR HYDROGEN INITIATIVE

Hydrogen offers significant promise as a future domestic energy source, particularly for the transportation sector. The use of hydrogen in transportation will reduce U.S. dependence on foreign sources of petroleum, enhancing national security. Hydrogen can be combusted in a traditional internal combustion engine, or can produce electricity in a fuel cell. Significant progress in hydrogen combustion engines and fuel cells is bringing transportation using hydrogen closer to reality. Before hydrogen can become a significant part of the Nation's energy infrastructure, the cost associated with the production, storage, and delivery of hydrogen must be reduced considerably.

Today, through electrolysis, we can convert water to hydrogen using electricity. Without using a non-emitting technology, such as nuclear or renewable energy, to produce the electricity, the environmental benefits of electrolysis are negated. We believe that for the future, Generation IV systems coupled with advanced hydrogen production technology offer a more efficient technology for production of large quantities of hydrogen without release of greenhouse gases. This technology could pave the way for the commercial production of clean-burning hydrogen for transportation purposes—reducing our reliance on imported fossil fuels and supporting the President's vision for a future Hydrogen economy.

The *DOE Hydrogen Posture Plan and the Nuclear Hydrogen R&D Plan* outline our plan for integrating and implementing technology research, development and demonstration activities needed to cost-effectively produce, store, and distribute hydrogen for use in fuel cell vehicles and electricity generation. These documents are revised periodically and used to inform our annual budget requests. Technology de-

velopment work to date, which has been conducted in accordance with these plans, has proven successful. For example, last year, experiments were successfully completed on individual high-temperature electrolysis cells for hydrogen production. Since the results show that the hydrogen output of the cells closely matched the theoretical calculations, this year we are evaluating the performance of stacks of cells to achieve higher hydrogen production rates. In FY 2006, the program will proceed with the plan to test cell stacks for long-duration and transient operation. As a result of these achievements, the FY 2006 budget request includes an increase of $11 million to conduct research and development on processes that operate across a range of temperatures for various advanced reactors being considered under the Generation IV Nuclear Energy Systems Initiative.

FISCAL YEAR 2006 BUDGET REQUEST

ADVANCED FUEL CYCLE INITIATIVE

In addition to leading the development of a new generation of nuclear power plants, the Department is developing and demonstrating technologies that will enable the United States and other advanced countries to implement an improved, long-term nuclear fuel cycle that provides substantial environmental, nonproliferation, and economic advantages over the current once-through nuclear fuel cycle. The Advanced Fuel Cycle Initiative is a research program to develop new technologies for reducing the volume, toxicity, and longevity of the high-level nuclear wastes that result from the production of energy from nuclear power plants. The initiative is designed so that these technologies can be made available to support the operation of current nuclear power plants, Generation III+ light-water reactors, and Generation IV advanced reactors in order to achieve a significant reduction in the amount of high-level radioactive waste requiring geologic disposal; to significantly reduce the amount of plutonium accumulated in civilian spent nuclear fuel; and to extract more useful energy from nuclear fuel.

Under all scenarios, the Nation will need to establish a permanent geological repository to deal with the radioactive wastes resulting from the operation of nuclear power plants. Substantial growth in the use of nuclear energy in the United States will require the construction of additional geologic repositories to address the nuclear waste generated over time. The advanced research conducted under the Advanced Fuel Cycle Initiative, if successful, could provide an alternative to building multiple "Yucca Mountains" while still supporting an expanding role for nuclear power in the United States. In the longer-term, the Advance Fuel Cycle Initiative could enable us to extend the useful life of the Yucca Mountain repository and reduce the radiotoxicity of the wastes it contains such that it would decay to the toxicity of natural uranium ore in less than 1,000 years—instead of over 100,000 years as is the case with untreated spent fuel. This technology could also allow nuclear plants to exploit a far higher fraction of the energy contained in uranium ore, potentially expanding the lifetime of the world's nuclear fuel resources from around 100 years up to 1,000 years.

The Advanced Fuel Cycle Initiative, with an investment of $70 million for FY 2006 (an increase of $2.5 million compared to FY 2005), will continue the progress made in the development of proliferation-resistant treatment and transmutation technologies that can reduce both the volume and toxicity of spent nuclear fuel. These technologies would support both national security and energy independence by reducing inventories of commercially-generated plutonium while recovering residual energy value from spent nuclear fuel. If successful, these same technologies offer benefits of enhancing national security by reducing inventories of commercially-generated plutonium and enhancing energy independence by recovering the energy value contained in spent nuclear fuel.

The program has already enjoyed considerable success. We have proven the ability of our URanium EXtraction (UREX) technology to separate uranium from spent fuel at a very high level of purity. We have demonstrated the ability of a derivative technology, UREX+, to separate a combined mixture of plutonium and neptunium that can serve as the basis for a proliferation-resistant fuel for light water reactors. While the UREX+ process has great potential to address the spent fuel challenges associated with today's light water reactors, we have also been investigating an alternative separation technology called pyroprocessing. This technology is a highly efficient, proliferation-resistant nonaqueous approach to separate the actinides in spent fuel from fission products. Among other potential applications, pyroprocessing could support the reduction of the radiotoxicity of nuclear waste through the transmutation of minor actinides in future Generation IV fast spectrum reactors providing the means for closure of the fuel cycle for Generation IV fast reactors.

For the Advanced Fuel Cycle Initiative to be successful, advanced fuel treatment and transmutation research and development must be integrated with the develop-

ment of Generation IV nuclear energy systems, particularly with those reactor technologies that can produce the high energy neutrons needed to transmute a wide variety of toxic radioactive species. We have organized our national labs, universities, and international collaborations in a manner that will enable the success of the Advanced Fuel Cycle Initiative.

FISCAL YEAR 2006 BUDGET REQUEST

UNIVERSITY REACTOR INFRASTRUCTURE AND EDUCATION ASSISTANCE

In addition, the Department has paid close attention to developments impacting university research reactors. The research conducted using these facilities is critical to many national priorities. Currently, there are 27 operating university research reactors at 26 campuses in 20 states. These reactors are providing support for research in such diverse areas as medical isotopes, human health, life sciences, environmental protection, advanced materials, lasers, energy conversion and food irradiation.

The most exciting development in University Reactor Infrastructure and Education Assistance is the Innovations in Nuclear Infrastructure and Education (INIE) Program established in FY 2002. The consortia have demonstrated remarkable collaborative efforts and strong formation of strategic partnerships between universities, national laboratories, and industry. These partnerships have resulted in increased use of the university nuclear reactor research and training facilities, upgrading of facilities, increased support for students, and additional research opportunities for students, faculty and other interested researchers. Today, the Department funds six INIE consortia, providing support to 32 universities in 23 states across the Nation.

To complement INIE and the other university assistance programs, the University Reactor Infrastructure and Education Assistance program provides assistance to universities to improve the operational and experimental capabilities of their research reactors and provides for the fabrication and shipment of fresh fuel to their research reactors.

Grants are provided to universities to purchase equipment and services necessary to upgrade the reactor facilities, such as reactor instrumentation and control equipment, data recording devices, radiation, security and air monitoring equipment, and gamma spectroscopy hardware and software. Each year, as many as 25 universities request and receive this assistance. The Reactor Sharing program enables universities with reactors to "share" access to their facilities with students and faculty at their own institutions, with universities that lack such a facility, and with visiting students from other local institutions including high schools and middle schools. The reactors are made available for use in research, experiments, material irradiations, neutron activation analysis and training, and for facility tours and other educational activities.

The growth of nuclear energy in the United States is dependent on the preservation of the education and training infrastructure at universities. The Department has played a substantial role in reversing the decline in undergraduate enrollments in this area of study. In 1998, the United States saw only around 450 students enroll as nuclear engineers—down from almost 1,500 in 1992. After several years of focused effort, the United States now has nearly 1,600 students studying nuclear engineering. That number is set to increase further, as strong programs—such as at Purdue and Texas A&M—continue to grow and we see new programs start at schools such as South Carolina State University, the University of South Carolina, and the University of Nevada-Las Vegas. Given the very large number of retirements expected in the nuclear field over the next five to ten years, industry, government, and academia find that this upswing in student interest comes at a critical time.

The Department provides tuition, stipends, and a practicum to outstanding graduate students studying nuclear engineering and health physics and scholarships and a practicum to undergraduate students pursuing a nuclear engineering course of study. This highly competitive program has produced outstanding graduates who have become leaders in nuclear research and university education. Also, within the fellowships and scholarships program is the University Partnership program, which encourages students enrolled at minority-serving institutions to pursue a nuclear engineering degree at universities with nuclear engineering programs. There are currently six university partnerships consisting of 13 institutions working cooperatively in this innovative program. South Carolina State University (SCSU) and the University of Wisconsin were involved in the pilot program and now SCSU administers the program for all university partnership members. SCSU has also added two nuclear engineering faculty members and has become the only historically black

college or university in the United States with an accredited nuclear engineering program.

We continue our small but important effort to provide scholarships and graduate fellowships to students studying the vital and too-often overlooked discipline of health physics. The Department is concerned that the Nation may soon not have the trained health physicists who are needed to assure the safety of vital nuclear and radiological activities. This program will help heighten the visibility of health physics as a viable career opportunity and strengthen the health physics pipeline to replace retiring professionals.

The Nuclear Engineering Education Support program prepares students for nuclear engineering and science careers and assists universities with special needs to improve their educational infrastructure. This program is helping to address the knowledge gap of incoming college freshmen in the area of nuclear science and engineering. In FY 2005 a nuclear science and technology education pilot was established between the Department and the Pittsburgh Public School System to provide advanced placement high school science students an intensive educational experience in the field of nuclear science and technology. This effort provides course materials, tours to nuclear facilities, and lectures from internationally-recognized experts. In FY 2006, the program will expand its efforts to enlist local organizations in sponsoring the model used in the Pittsburgh pilot program to other school systems across the country, thereby strengthening the understanding of nuclear science in our public schools.

The President's Budget supports continuation of the University Reactor Infrastructure and Education Assistance Program in FY 2006 with a request of $24 million (an increase $190K compared to FY 2005).

FISCAL YEAR 2006 BUDGET REQUEST

RADIOLOGICAL FACILITIES MANAGEMENT

In addition to nuclear research and development programs, we have the responsibility to maintain and enhance the Nation's nuclear science and technology infrastructure. This budget request also includes $64.8 million (a decrease of $3.7 million compared to FY 2005) to fund the management of the Department's vital resources and capabilities at Oak Ridge National Laboratory, Los Alamos National Laboratory, Sandia National Laboratory, and Brookhaven National Laboratory in a safe, secure, and cost effective manner to support national priorities. The mission of the Radiological Facilities Management program is to maintain these critical user facilities in a safe, environmentally-compliant and cost-effective manner to support national priorities. These funds assure that NE facilities meet essential safety and environmental requirements and are maintained at user-ready levels. Actual operations, production, research, or other additional activities are funded either by other DOE programs, by the private sector, or by other federal agency users.

The Department is responsible for maintaining the necessary nuclear material and infrastructure that is required to deliver plutonium-238-fueled radioisotope power systems (using plutonium-238) to various federal users. These systems are an irreplaceable enabling technology for deep space exploration missions and national security missions. As part of the Department's emphasis on consolidating nuclear material, increasing nuclear security, reducing nuclear risks, and addressing secure transportation issues, we are currently performing an environmental review to assess the consolidation of all of our plutonium-238 operations. DOE has identified consolidation at the Idaho National Laboratory as the preferred alternative for this proposed action.

In addition, the Radiological Facilities Management program assures appropriate oversight of the operations and maintenance of the Department's Paducah Gaseous Diffusion Plant uranium enrichment facilities to assure that USEC Inc. meets its commitments under the 2002 DOE–USEC Agreement and that the Government's rights and options are being preserved.

The FY 2006 $64.8 million budget request includes $18.7 million to prepare the final design, procure equipment, and begin facility modifications for the Uranium-233 Disposition Project at Oak Ridge National Laboratory. This project is aimed at stabilizing materials left over from the Cold War to address a Defense Nuclear Facilities Safety Board recommendation, while extracting isotopes from the uranium that are needed for very promising medical research.

FISCAL YEAR 2006 BUDGET REQUEST

IDAHO FACILITIES MANAGEMENT AND IDAHO SITEWIDE SAFEGUARDS AND SECURITY

The Idaho Facilities Management program maintains the Department's facilities at Idaho in a safe, secure and environmentally compliant condition for a range of vital federal missions. The Idaho Site-wide Safeguards and Security program supports activities that are required to protect the Department's Idaho complex assets from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts which may cause unacceptable adverse impacts on national security, program continuity, the health and safety of employees, the public, or the environment.

We have now established the Idaho National Laboratory (INL), which combines the resources of the former Idaho National Engineering and Environmental Laboratory (INEEL) and the former Argonne National Laboratory-West (ANL–W). This new lab began operations on February 1, 2005, and will lead much of the Department's exploration into advanced nuclear reactor and fuel cycle technology. We have set an aggressive goal for the new INL to become the world's premier center for nuclear energy research and education within a decade.

Developing a central research laboratory is a major step forward for the nuclear energy program. We have now joined the other key energy programs at the Department by having a central, dedicated research site at which we can centralize our infrastructure investments and build the expertise needed to accomplish our program goals. A central lab also helps us minimize the shipment of nuclear materials across the country and allows us to bring our nuclear materials together in a single, secure location. In addition, we expect that our new central, dedicated research laboratory will become a major player in the education of the next generation of nuclear energy technologists that this nation will need to assure our energy security in the future.

Our funding request of $80.1 million from Energy Supply and $17.8 million from Other Defense Activities for the Idaho Facilities Management program maintains and operates the Department's facilities at Idaho in a safe, reliable, and environmentally compliant condition for a range of vital federal missions. The overall funding for the Idaho Facilities Management program decreases from FY 2005 to FY 2006 because of a $43.4 million one-time cost associated with restructuring the INL complex and supporting site infrastructure services. This decrease is offset by an increase of $19.7 million for maintenance and recapitalization projects to support the goal of achieving and maintaining an expenditure rate of two to four percent of Replacement Plant Value, a level recommended by the National Academy of Sciences and incorporated in Departmental guidance, for the facilities at INL. One of the essential facilities for ongoing and planned national security and energy research programs at the INL is the Advanced Test Reactor (ATR). Replacing the ATR with a new test reactor with similar capabilities would exceed two billion dollars and likely take at least ten years to build. An independent review group of reactor experts studied the ATR and provided their perspectives on the life extension of the reactor. This review prompted several projects, most notably an exhaustive safety basis reconstitution to assure that all safety related systems meet modern standards. This project is in progress and results to date are favorable.

The recommendations of this review and other analyses will be incorporated into the INL Ten Year Site Plan (TYSP), which is the foundation for INL facilities and infrastructure strategic planning and the cornerstone of the Program's initiative to restore the INL and the other essential facilities on the site. The TYSP provides recommendations for short- and long-term recapitalization of existing mission essential facilities and infrastructure. The TYSP identifies and prioritizes the project, activities, and mission resource requirements for real property assets that cover a ten-year planning horizon as well as includes a prioritized list of maintenance, repair, and recapitalization projects necessary to correct the maintenance backlog.

Our budget request of $75 million (an increase of $17.3 million compared to FY 2005) from the Other Defense Activities appropriations account for the Idaho Sitewide Safeguards and Security program supports activities that are required to protect the Department's Idaho complex assets from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts which may cause unacceptable adverse impacts on national security, program continuity, the health and safety of employees, the public, or the environment. As a result of merging the former INEEL and ANL–W sites into the INL, the two existing safeguards and security programs at the Idaho site will be merged into a single program. This integration will continue in FY 2005 with additional changes anticipated to increase efficiency and contain costs for safeguards and security for the site.

The Department issued a revised Design Basis Threat in October 2004. These requirements will be implemented using a risk-informed approach to physical upgrades and by seeking efficiencies associated with combining the two contracts. The Department believes that early investment in improved positions for defending forces, more capable detection systems, and technological deterrent devices at target locations will result in cost avoidance over the lifetime of enduring facilities by reducing the number of additional protective force members needed to counter the revised threat. The FY 2006 request reflects increased funding of $17.3 million to permit these investments.

CONCLUSION

Our nation cannot rely on any single energy technology to secure its future. A broadly diverse energy supply has served us well in the past and must be available for the future. Nuclear energy should be a part of that diverse portfolio as look to support our growing economy while limiting air emissions and enhancing America's energy independence.

The Department of Energy's goal is to work with the private sector, our overseas partners, and other agencies to assure that the benefits of nuclear technology continue to increase the security and quality of life for Americans—and other citizens of the world—now and into the future.

This concludes my prepared statement. Your leadership and guidance has been essential to the progress the program has achieved thus far and your support is needed as we engage the tasks ahead.

I would be pleased to answer any questions you may have.

BIOGRAPHY FOR ROBERT SHANE JOHNSON

Shane Johnson is the Acting Director of DOE's Office of Nuclear Energy, Science and Technology. He was appointed to this position in May 2005, upon the resignation of the prior Director.

In this capacity, Mr. Johnson leads the Department's nuclear energy enterprise, including nuclear technology research and development; management of the Department's nuclear technology infrastructure; and support to nuclear education in the United States. Mr. Johnson also serves as the Lead Program Secretarial Officer for the Idaho National Laboratory, the Department's lead laboratory for nuclear technology research, development and demonstration.

Since 2000, Mr. Johnson has led the Office's nuclear technology initiatives, serving a key leadership role in the initiation and management of all of the Office's major research and development initiatives, including the Generation IV Nuclear Energy Systems Initiative, the Advanced Fuel Cycle Initiative, and the Nuclear Hydrogen Initiative. In 2004, Mr. Johnson was promoted to the position of Deputy Director for Technology, where his responsibilities also include management of the Nuclear Power 2010 program and initiatives aimed at strengthening university nuclear science and engineering programs in the United States.

Mr. Johnson serves a central role in the Department's efforts to re-assert U.S. leadership in nuclear technology development. He led the formation of the *Generation IV International Forum* (GIF), an international collective of ten leading nations and the European Union's Euratom, dedicated to developing advanced reactor and fuel cycle technologies. He leads the Office's international cooperation activities, including establishment of cooperative research agreements with other countries and the development by the GIF of the Generation IV technology roadmap, which resulted in the selection of six promising reactor and fuel cycle technologies by the GIF for future development efforts. Mr. Johnson currently serves as the Acting Chairman of the GIF, pending election of a permanent chairman and has served as the U.S. representative to the policy committee since 2001.

Mr. Johnson has over twenty years of relevant management and engineering experience within Government and industry. Prior to joining DOE, Mr. Johnson was employed for five years by Duke Power Company and Stoner Associates, Inc. where he was responsible for performing engineering studies for nuclear, natural gas, and water utilities.

Mr. Johnson received his B.S. degree in Nuclear Engineering from North Carolina State University and his M.S. degree in Mechanical Engineering from Pennsylvania State University. He is a licensed professional engineer.

Chairwoman BIGGERT. Thank you very much.

And last but not least, Mr. Kolevar is recognized for five minutes.

STATEMENT OF MR. KEVIN M. KOLEVAR, DIRECTOR OF THE OFFICE OF ELECTRICITY DELIVERY AND ENERGY RELIABILITY, THE DEPARTMENT OF ENERGY, WASHINGTON, DC

Mr. KOLEVAR. Thank you Chairman Biggert and Members of the Subcommittee for the opportunity to testify today on the science and technology priorities for fiscal year 2006 within the newly-established Office of Electricity Delivery and Energy Reliability.

The Office of Electricity Delivery and Energy Reliability resulted from the consolidation of several programs within the Department. Consistent with the *Appropriations Act of 2005,* DOE's Energy Security and Assurance program has been merged with those of the former Office of Electric Transmission and Distribution. In addition, the Import/Export Authorization electricity activity previously administered by the Office of Fossil Energy is now housed in this new office.

Our mission is to lead national efforts to modernize the electricity delivery system, enhance the security and reliability of America's energy infrastructure, and facilitate recovery from disruptions to energy supply. This is vital to the Department's strategic goal to protect our national and economic security by promoting a diverse supply and ensuring delivery of reliable and affordable energy.

The Research and Development program is intended to contribute to the modernization of the electricity system. It consists of six main activities that are continuing from 2005: high-temperature superconductivity, transmission reliability, electric distribution transformation, energy storage, GridWise, and GridWorks.

The High-Temperature Superconductivity program supports development of second-generation wire that is useable in cables, generators, transformers, and motors: equipment that crosscuts the entire electric power value chain. High-temperature superconductors are a good example of advanced materials that have the potential to transform electric power delivery in America. The prospect of transmitting large amounts of power through compact underground corridors with minimal electrical losses over long distances could significantly enhance the overall energy efficiency and reliability of the energy system.

The transmission reliability R&D activity supports modernization of the Nation's transmission infrastructure through technologies that provide enhanced grid reliability and efficient electricity markets on our competition. The transmission reliability activity focuses on developing real-time monitoring and control software tools and system operating models for grid operators that I would be happy to expound on in the question and answer period, if necessary.

The electric distribution R&D activity supports R&D that will enable the development and testing of advanced technologies and standards for interconnection of distributed energy resources to the electricity grid. The technology will foster the full integration of distributed resources into distribution operations and lead to increased asset utilization and enhanced system reliability for the entire national electrical system.

The energy storage R&D includes research in advanced energy storage devices for applications ranging from power quality for dig-

ital facilities to voltage support for transmission lines. The energy storage activity emphasizes buffering technologies and the design of storage systems with integrated power electronics and controls that are dedicated to improving the reliability of the grid.

GridWise denotes a modernized electric infrastructure framework where open but secure communication and information technologies are used throughout the grid to enhance reliability and robustness and promote economic efficiencies. The GridWise activity, which is software-centric, comprises the intelligence, or brains, behind a modern electric grid that incorporates GridWorks, which is hardware-centric technology.

The GridWorks activity focuses on advanced equipment application and is designed to accelerate the development and testing of advanced conductors, which can increase much-needed transmission line capacity. GridWorks pursues advanced power electronic breakthroughs to develop new transformers, breakers, and current limiters to provide faster means of limiting transmission problems before they propagate through the electric system.

The electricity-restructuring program within this new office provides technical assistance and analytical support to states and regions to facilitate competitive and reliable wholesale and retail electric markets. This program includes modeling and analysis to identify the causes of reliability events and recommendations for avoiding such future events.

The electricity restructuring program also includes activities formerly assigned to the Office of Energy Assurance, namely working with stakeholders to bolster the security of the Nation's critical energy infrastructure, and this program is responsible for coordinating and carrying out the Department's obligations to support the Department of Homeland Security in this important national effort.

Madame Chairman, I thank you for the opportunity to testify today. I look forward to working with you to make progress in these critical areas. And I am happy to answer any questions.

[The prepared statement of Mr. Kolevar follows:]

PREPARED STATEMENT OF KEVIN M. KOLEVAR

OFFICE OF ELECTRICITY DELIVERY AND ENERGY RELIABILITY

OVERVIEW

Chairman Biggert and Members of the Subcommittee, thank you for the opportunity to testify today on the science and technology priorities for Fiscal Year (FY) 2006 within the newly established Office of Electricity Delivery and Energy Reliability.

The Office of Electricity Delivery and Energy Reliability, referred to as the Office of Electric Transmission and Distribution (OETD) within the FY 2006 budget request, resulted from the consolidation of several programs within the Department. Consistent with the Conference Report to the *Consolidated Appropriations Act of 2005,* the Energy Security and Assurance Program activities were merged with those of OETD. In addition, the Import/Export Authorization (IEA) electricity activity was transferred from the Department's Office of Fossil Energy under the Interior and Related Agencies Appropriation to OETD under the Energy and Water Development Appropriation.

The mission of the Office of Electricity Delivery and Energy Reliability (OE) is to lead national efforts to modernize the electricity delivery system, to enhance the security and reliability of America's energy infrastructure, and to facilitate recovery

from disruptions to energy supply. This is vital to the Department's strategic goal to protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

The Administration has requested $95.6 million for OE in FY 2006. This includes $71.8 million for research and development activities, $12.4 million for electricity restructuring activities, and $11.4 million for Program Direction funds to provide for programmatic management and to enable the Department to execute its sector-specific responsibilities under Homeland Security Presidential Directive (HSPD) 7—"Critical Infrastructure Identification, Prioritization, and Protection" and its emergency support responsibilities as mandated by HSPD 8—"National Preparedness."

RESEARCH AND DEVELOPMENT

The Research and Development (R&D) program within OE, which will contribute to the modernization of the electricity system, consists of six main activities that are continuing from FY 2005: High Temperature Superconductivity; Transmission Reliability; Electric Distribution Transformation; Energy Storage; GridWise; and GridWorks.

The High Temperature Superconductivity activity supports development of second generation wire that is usable in cables, generators, transformers, and motors—equipment that crosscuts the entire electric power value chain. High temperature superconductors are a good example of advanced materials that have the potential to transform electric power delivery in America. The prospect of transmitting large amounts of power through compact underground corridors, with minimal electrical losses over long distances, could significantly enhance the overall energy efficiency and reliability of the electric system. In addition, high temperature superconductors have the potential for revolutionizing a variety of military propulsion and directed energy weapon applications where high power density, as well as reduced size and weight at reasonable cost, is absolutely essential.

The Transmission Reliability R&D activity supports modernization of the Nation's transmission infrastructure through technologies that provide enhanced grid reliability and efficient electricity markets under competition. The Transmission Reliability activity focuses on developing real-time monitoring and control software tools and system operating models for grid operators, and market design research, including demand response integration, to support restructured markets development. An example of this ongoing effort is the Eastern Interconnection Phasor Project (EIPP). The EIPP is a network of time-synchronized data recording instruments that monitor the equivalent of the grid's heartbeat and blood pressure in near real-time. It provides early warning about possible disturbances, while they are still manageable.

The Electric Distribution R&D activity supports R&D that will enable the development and testing of advanced technologies and standards for interconnection of distributed energy resources into the electricity grid. This technology will allow the full integration of distributed resources into distribution operations, and lead to increased asset utilization and enhanced system reliability for the entire national electrical system.

The Energy Storage R&D activity includes research in advanced energy storage devices for applications ranging from power quality for digital facilities to voltage support for transmission lines. The Energy Storage activity emphasizes the design of storage systems with integrated power electronics and controls that are dedicated to improving the reliability of the grid, including mitigation of grid congestion and increasing grid stability by reducing the incidence of power quality disturbances.

GridWise denotes a modernized electric infrastructure framework where open, but secure, communication and information technologies, and associated standards and protocols, are used throughout the electric grid to enhance reliability and robustness, promote economic efficiencies, and provide value and choices to electricity consumers. The GridWise activity (software-centric) comprises the intelligence—or brains—behind a modern electric grid that incorporates GridWorks (hardware-centric) technology.

The GridWorks activity focuses on advanced equipment applications. GridWorks uses the facilities at DOE's national laboratories to accelerate the development and testing of advanced conductors, which can increase much needed transmission line capacity. It complements GridWise's architectural software development by developing and demonstrating associated hardware, such as sensors. GridWorks pursues advanced power electronic breakthroughs to develop new transformers, breakers, and current limiters, to provide faster means of limiting transmission problems before they propagate through the electric system.

ELECTRICITY RESTRUCTURING

The Electricity Restructuring program provides technical assistance and analytical support to States and regions for policies, market mechanisms, and activities that facilitate competitive, reliable, environmentally sensitive, and customer-friendly wholesale and retail electric markets. This program includes modeling and analysis to identify the causes of reliability events, and development and implementation of policy-related recommendations for avoiding such future events.

The Electricity Restructuring program also includes activities formerly assigned to the Office of Energy Assurance. The President has designated the Department of Energy as the Lead Sector-Specific Agency responsible for protecting the Nation's critical energy infrastructure, and this program is responsible for coordinating and carrying out the Department's obligations to support the Department of Homeland Security in this important national initiative.

MOVING RESEARCH INTO THE MARKETPLACE

I would like to turn now to discuss moving the research into the marketplace. There are several barriers to the acceptance of new electricity transmission and distribution technologies. These include the capital intensive nature of grid assets, the long life-span of transmission infrastructure which results in a slow turnover process, utility reluctance to invest in new technologies until their durability is ensured, hesitation to make investments until the future structure of the electricity sector is known, difficulties in siting new infrastructure, and permitting delays.

While DOE conducts research, development, field testing, and demonstration of technologies that will facilitate modernization of the grid, as well as identifies and addresses public policy issues that impact grid modernization, the private sector (as well as public power) must make the necessary infrastructure investments to actually modernize the grid. It is a complicated process that will require unprecedented levels of cooperation among the electric power industry's diverse stakeholders. The Federal Energy Regulatory Commission has recently taken action on a case-by-case basis to authorize transmission rate incentives that can provide greater certainty to investors and thus encourage quicker, appropriate investments in grid improvement.

OE has made progress as well—pursuing dialogue with industry, shaping a shared vision of the future, and identifying a pathway to get us there. The Office is working with State commissions to familiarize them with the new grid technologies and the extent to which their reliability has been demonstrated. Although DOE has made progress, much more progress needs to be made.

Modernization of our aging energy infrastructure will help reduce the risk of large-scale blackouts and minimize transmission bottlenecks. The Administration commends the House for again passing energy legislation which includes an electricity title that will achieve many of the Administration's policy objectives to improve reliability, protect consumers, increase supply, and promote efficient markets.

Although I only identified a few key projects, there are many beneficial technologies that are ready to be deployed. But what is lacking is industry certainty on what a "restructured" electricity sector will look like in the future. This can be overcome by repealing outdated rules that discourage investment in new infrastructure, as the recently passed energy bill will do, and by encouraging the development of new technologies to make the grid more efficient, reliable, and secure.

I thank you for the opportunity to testify today. I look forward to working with you to make progress in these critical areas. Madam Chairman, this concludes my testimony and I would be happy to respond to any questions from the Committee.

BIOGRAPHY FOR KEVIN M. KOLEVAR

Kevin Kolevar is Director of the Department of Energy's (DOE) newly established Office of Electricity Delivery and Energy Reliability.

The new office develops and helps implement national policy pertaining to electricity transmission and distribution, electric grid reliability, and electric grid technology research and development. It also leads federal efforts to help ensure and secure the reliable flow of energy to homes, industry, public service facilities and the transportation system.

Before taking this position, Kolevar served as Chief of Staff to Deputy Secretary of Energy Kyle McSlarrow from January, 2003 to January, 2005. In that position, he supported and advised the Secretary and Deputy Secretary on policy, regulatory, and legislative matters as well as Departmental program management. Prior to serving as Chief of Staff to the Deputy Secretary, Kolevar worked as a Senior Policy Advisor to the Secretary of Energy on security and technology issues.

Mr. Kolevar is the former Chair of the Department of Energy National Security Working Group and was a senior advisor to the U.S.-Canada Task Force that investigated the 2003 blackout. Before coming to DOE, Kolevar spent over 10 years working in the Senate on the staffs of Senators Spencer Abraham (R–Mich.) and Connie Mack (R–Fla.).

DISCUSSION

Chairwoman BIGGERT. Thank you very much, Mr. Kolevar.

And now it is our turn to ask the questions, which we limit to five minutes, also.

And so my first question would be for Mr. Johnson, Mr. Faulkner, Mr. Kolevar, and Mr. Maddox, unless somebody else finds that they really have to answer it, also.

The Department has often said that the appropriate role of federal funding of research is for high-risk activities with a potentially high payoff and demonstration projects that are both a useful step in developing technologies and a means to stimulate commercialization of mature technologies but are generally lower risk than other activities that might be undertaken. And recently, the Department has characterized some major projects as "learning demonstrations" and so they are necessary to understand the challenges facing new technologies. What are the—in your opinion, what are the criteria the Department uses to graduate activities from the laboratory to the demonstration phase? And what are the characteristics that distinguish a learning demonstration from a technical demonstration?

Who would like to start with that?

Mr. Faulkner, you look ready.

Mr. FAULKNER. I am trying not to look ready.

Several questions are embedded there. Let me make several points. One of them is my office has a range of technologies. I think we have a diverse portfolio. We look at a lot of things in determining our budget. We look at national priorities. We look at where the technologies are in the marketplace. Are private sector companies spending more money over time? We look at where our partners are spending money in the Federal Government. We think that we have a good balance in our portfolio between research and development and demonstration technologies. We do a lot of analysis, like when we do our budget formulation in the spring. We look at a lot of these things: priorities, risk. What are the benefits of these technologies? Where do they stand? And so it is kind of a balance that you have to get to in terms of—it is almost like a 3–D chess game in terms of determining where you put your money on what technologies.

Chairwoman BIGGERT. Is there a difference between what we would call learning demonstrations and those that are just demonstration projects?

Mr. FAULKNER. Well, in the hydrogen program, which you may be referring to, they have learning demonstrations, and they consider there is a difference between that and deployment demonstrations. They think that these learning demonstrations are an extension of the marketplace. We are trying to get data to help us do our research better. And a pre-commercialization deployment demonstration test the market and large volumes are created to try

and see how the technologies are adapting, how the production costs are—whether you can reduce the production costs. And I think in the hydrogen program, we think the learning demonstration is just right, right now, because the marketplace is pretty immature for more—the other kind of demonstration projects.

Chairwoman BIGGERT. Okay. Thank you.

Mr. Maddox.

Mr. MADDOX. Thank you. I will try to remember all of these questions. I tried to take notes as we went through here.

Very quickly, our balance is driven, and our portfolio, is driven by a couple different drivers. One of them is our larger policy driver, which is essentially to take our most abundant resource, coal, and allow it to be burned cleanly.

A second driver is what we see called regulatory drivers. For instance, the mercury regulations have been out there for a while, and so we have been putting a large amount of resources into trying to create a mercury technology that can remove mercury. So that is a real driver as things come forward on the regulatory front.

This Administration had a very strong policy, you can't create regulations unless there is underlying technology to support meeting those regulations. So for instance, if we want to limit mercury to 90 percent, we have got to find a way to limit mercury and capture that emissions. So that is the issue on that.

In determining demonstration projects, usually that is coming post-pilot phase, which we consider the—more the R&D phase where we feel we have reasonable confidence that a project may work at a large scale. For us, that is electricity production usually in the 275 and up range. And that is also limiting. A good example of that is our IGCC plant outside Tampa, where it initially started, I think, with 30 percent reliability and after eight years of tweaking it, learning how it works, we have now got a stable operation that is actually available in the 80-plus percentage time. It is now commercially dispatching energy and is no longer a demonstration project. It graduated to commercial.

So that is, in a nutshell, how our process works. All of our demonstrations are a combination of technical and learning.

Chairwoman BIGGERT. All right. Thank you.

Mr. Johnson.

Mr. JOHNSON. Thank you, Madame Chairman.

I would characterize the Office of Nuclear Energy's research and development programs as being planned through, essentially, three phases: a laboratory demonstration, a pilot-scale demonstration, and then eventually bearing merit, an engineering-scale demonstration.

Given the nature of our work, we are, in all of our R&D programs in the Office of Nuclear Energy, still on the laboratory scale, whether it is in our advanced fuel cycle looking at spin fuel separation technologies or in our nuclear hydrogen initiative looking at the various chemical processes for splitting water into hydrogen and oxygen. We are clearly still at the laboratory scale, and we will remain there until such time as the technology proves to be sufficiently mature to move on to a larger scale operation. And the approach we take is to ensure that we have a good understanding of the science and engineering on a laboratory scale before making

the investments to move up into a larger scale facility. For example, our nuclear hydrogen program is looking at thermochemical reactions. Currently in the laboratory, that is characterized as on a watt scale. Our plans to scale that up into pilot would be on the kilowatt range, and then an engineering scale would take us into a megawatt range for the hydrogen production. So what we have is a graduated program with clear delineation between the phases of the R&D and, hopefully in the not-too-distant future, we will be able to move from the laboratory scale into the pilot scale activities.

Chairwoman BIGGERT. Thank you.

And Mr. Kolevar.

Mr. KOLEVAR. Madame Chairman, I think, because of the nature of our office, we are a little different than—from our sister applied R&D programs in that the technologies that we are working to develop and get into the system are kind of going into the middle of an up and running system. They are not an end use connection, if you will. So to the extent that there is a difference between, with respect to criteria, learning versus technical, I guess we would have to focus more on the technical side, and it is because of the nature of the challenges that we face in pursuing and working with industry and the states to get the technology into the system.

We understand—typically, going in, and while we do demo these things across the lab complex, we understand, fairly well going in, the specifications, and we have a pretty good idea of the effectiveness of a lot of the technologies that we demonstrate. We have a good sense of what we are going to get after all of the time that we have spent in the lab application. What is particularly difficult is working with industry to convince them, and to get the necessary information to ensure that we have conforming standards and protocols for connectivity in getting new software into the system or hardware into the system and to prove beyond a doubt to a utility that this technology will work and it will not cause some kind of system failure that they pay for, that they are targeted for, because the reliability suffers and the consumers come back to them. I mean, this is an up and time—real-time up and running system that has to maintain 24/7 operations. And so it is typically a delicate balancing act, and that is the challenge we face is to really convince them that this technology will work, that their reliability will improve as a result of it, and not suffer during a demonstration on the system itself.

Chairwoman BIGGERT. Thank you.

My time has expired.

And I would recognize the gentlewoman from California, Ms. Woolsey, for five minutes.

Ms. WOOLSEY. Thank you, Madame Chairman.

First I would like to ask unanimous consent to enter my opening remarks into the record.

Chairwoman BIGGERT. Without objection.

Ms. WOOLSEY. Thank you very much.

I am sorry. I missed most of your testimony. I know you were wonderful, every—each and every one of you.

My goal is that this country of ours becomes the globe—globally, actually, becomes independent of fossil fuels as soon as possible, and I believe we can do that by investing in clean, renewable en-

ergy sources, creating incentives for conservation and efficiency and new technologies, and in other words, invest in the future. So just know that when I am asking you my questions. That is where I come from.

I represent Marin and Sonoma Counties, the two counties just north of San Francisco across the Golden Gate Bridge, which could give you a little bit of an idea of my constituency. We are very green. We are looking to the future, and we think we can be doing things a little differently than we are.

My first question today is for you, Dr. Orbach. I was interested in what the Committee has recently been aware of planning within the Office of Science, focusing on new directions for harnessing solar energies and solar power and converting it into solar to chemical with carbon-neutral fuel. What are you doing with that? How far are you with it? What kind of support are you getting from us and from the Administration? And what else do you need to make it go forward?

Dr. ORBACH. Thank you, Congresswoman Woolsey.

We have just finished a major workshop on solar energy where, as you have outlined, we have looked at those three areas of opportunity. What has changed has been the advent of nanotechnology and our ability to, within a given substance, understand how light is absorbed, solar light, and also how to separate charges, which is what nature does when it does photosynthesis. But we now think we know how to do that artificially. And so we have put a workshop together to give us guidance and future directions for solar energy that, hopefully, will open up new avenues and greater efficiencies and opportunities for us.

Ms. WOOLSEY. Well, tell me what you mean. Who is at that workshop, and what kind of incentives do those folks need that are at the workshop to carry out this—these future steps?

Dr. ORBACH. Well, we will be providing research support to the workshop members. There were over 200 members, I should say attendees, at the workshop. We originally planned, by invitation only, to have 70, but we just couldn't say no. They were, very roughly speaking, about half from universities, about a third from national laboratories, and I know it is not going to add up, another third, roughly, from industry.

Ms. WOOLSEY. An overlap.

Dr. ORBACH. And the—so it was a very broad spectrum. And here, actually, we work very closely with energy efficiency and renewable energy. The opening speaker was from our NREL facility, which is an EERE facility, who laid out what the research issues were. And then the focus of the workshop was to look at the near-term, what I will call, roadblocks to harnessing solar energy that were identified by EERE and then to take a look at some of the longer-term. Basically, plants are relatively efficient in terms of each photon absorbed, but they are inefficient in terms of taking advantage of the energy that they receive. And what we want to do is to use artificial structures, some of them mimicking biological structures, in order to make that whole process more efficient.

Ms. WOOLSEY. So I mean, I don't think we have a lot of time to dilly-dally on this, so what do you need from us to——

Dr. ORBACH. Well, we are currently exploring——

Ms. WOOLSEY.—make people——

Dr. ORBACH. We are currently exploring opportunities here—by the way, not just in solar.

Ms. WOOLSEY. Oh, wind?

Dr. ORBACH. We are also looking at hydrogen. We are looking at new materials. We are looking at a panoply of opportunities that—biomass is another one, that would assist energy independence, as you have outlined it. And we are putting together a research program in each of those areas. Hydrogen, for example, has already matured. We had 800 preproposals. We will be making about 70 grants next month for hydrogen research to do as I was describing before. So we are building this into our core research program and look forward to your support as we develop the specifics.

Ms. WOOLSEY. All right. Well, I look forward to working with you in getting language in legislation that will actually focus on what you are doing.

Chairwoman BIGGERT. Thank you.

The gentleman from Texas, Mr. Hall, is recognized for five minutes.

Mr. HALL. I yield to the gentleman who was here before I got here, Madame Chairman, Mr. Schwarz—Dr. Schwarz.

Chairwoman BIGGERT. The gentleman from Michigan is recognized for five minutes. I believe you were at the—listening to the testimony, but that is all right if you want to yield.

Dr. SCHWARZ. My questions are pretty elemental, but they are the questions that the folks at home are asking.

Nuclear power transmission technology, at least in the minds of the public, is relatively advanced, if we look especially at Western Europe and maybe even more especially at France. Can you tell me when you think there will be a new nuclear power-generating plant built in the United States and what impediments, if I am the CEO of Consumer's Power or DTE or ConEd, what impediments are in front of me in doing so, even knowing that I have to do it at some point in the future, sooner rather than later?

And whomever wants to address that, please feel free to do so.

Mr. JOHNSON. Yes, sir.

With respect to the decision to pursue a new nuclear power plant construction project in this country, as you know, that is clearly a decision of industry. What the Department is doing through its nuclear power 2010 program is partnering with industry to prove out the untested regulatory process at the Nuclear Regulatory Commission for the identification of reactor technologies, the identification of new sites onto which to build, and then finally the issuance of what is called the combined construction operating license.

We recently announced the awards of two partnerships with two industry-led teams. The preliminary plans that those two consortia have is that they are looking to submit the combined construction and operating license application to the NRC for its review and approval in the 2007 to 2008 time frame. The review process then at the NRC will take two to three years. I believe the preliminary schedules have—the decisions could be made by industry on moving forward with new nuclear generation, a plant order, in the 2009 to 2010 time frame.

Dr. SCHWARZ. Is there—I am sorry. If somebody else wanted to jump in, okay, but I have a couple more minutes, and I wanted to ask another question.

Is there a consensus in the energy research community and the commercial power-generating community that we have to go back to nuclear? That in the continuation of building and refining coal-fired plants, some natural gas-fired plants, there is a hard stop there someplace where we can't continue to build those plants that put out the fluvia that they put out, and we have to go to nuclear? It is a message that I think people need to learn and that people have to understand that at some point, the alternative, the clean power we are looking for is, in fact, nuclear power, back to the future, so to speak? Would anyone want to comment on that—on my comment?

Mr. JOHNSON. I would only add that the Department is supportive of a mixed energy production portfolio, not putting all of its eggs in the traditional basket of a single technology. So we envision that there is a role for nuclear, clean coal, solar, and the other renewables that it is part and parcel of a diversified energy production mix.

Mr. MADDOX. I might add too, that, you know, one of the things we have studied and looked at is our growing need for energy in the future and that there is an expectation that for us to maintain our economic growth and the energy to fuel that, we are looking at probably about 40 percent more energy over the next 20 years. This means that we really don't have the option of taking any energy source off the table and that we need more of everything, including more conservation.

We also are very sensitive to the fact that we need to make it cleaner. This Administration has virtually doubled the amount of money we are putting into clean coal research. We lead the world in our FutureGen project. I think everyone understands two things: we need more energy, and we need to make it cleaner. And our ability to simply discard any energy source is not a practical response.

Dr. SCHWARZ. Thank you very much.

Thank you, Mr. Chairman.

Mr. BARTLETT. [Presiding.] Thank you very much.

And the staff tells me that I am next in the cue.

Thank you all very much for your testimony.

A couple of weeks ago, I was at a breakfast, and a heritage fellow was speaking there. It was Peter Brooks, and he was talking in economics, and he made the statement that every country in the world that pumped oil had maxed out, except Saudi Arabia. Just as I was walking over here, the elevator was full, so I walked across the street with Don Young, the Chairman of the Transportation Committee, and he was commenting on the President's visit yesterday with the gentlemen from Saudi Arabia and—who said that they weren't going to increase oil production. And I offer the maybe the correct answer would have been, "Gee, Mr. President, we can't increase oil production." And Chairman Young agrees that that is probably true.

Do you think that these two people are wrong?

Nobody has volunteered that they are certain they are wrong. You all know, of course, of M. King Hubbard, a scientist of 60 years ago, who observed during the 1940s and the 1950s that an individual oil field was exploited on a bell curve, rapidly rising production during the early pumping and then reaching a peak at which about half of the field had been pumped, and then sliding down the other side. He theorized, as you know, that if you added up all of the little bell curves from the fields in the United States, you could predict when the United States would peak in oil production. He made that prediction in 1956, and he was right on target. He said it would be about 1970. It was exactly 1970 that we peaked in oil production.

We are now producing about half of the oil that we produced in 1970, as you know. We are sliding down Hubbard's peak.

In 1973, he did this analysis for the world, and he thought that the world would peak in oil production about 2000. He missed it a little, because he couldn't have known of the Arab Oil Embargo, which occurred later. He couldn't have known of the oil price spikes and of the worldwide recession, which delayed it. There are a number of observers who believe that we are now at peak oil.

What that means is that although world demand for oil is going up exponentially, not on a straight line the way your energy information agency depicts it, it is going up exponentially. And last year, China increased their use of oil about maybe as much as 25 percent. The world's economy grew at 10 percent last year. Our—I am sorry, five percent last year. Our economy grew at probably half of that last year. The third world is now wanting more oil, and they are using it very inefficiently. One of the best things we could do is to help them use energy efficiently.

While we are having greatly increased demands for oil, the production of oil will level off for a while, and then it will start sliding down Hubbard's peak, no matter what we do. One author, when writing about this, and don't throw his document down when you read it. I had a—was going to do that, but I read on, and it was hard to argue with his conclusion. "Dear readers: civilization, as we know it, is coming to an end soon. This is not the wacky proclamation of a doomsday cult, apocalypse bible prophecy sector, conspiracy theory society. Rather, it is a scientific conclusion of the best paid, most widely respected geologists, physicists, and investment bankers in the world. These are rational, professional, conservative individuals, who are absolutely terrified by phenomenon known as global peak oil." I, too, am concerned. Tell me that he is an idiot and I shouldn't be concerned.

Mr. HALL. Mr. Chairman, do you want it in that order?

Mr. BARTLETT. No. I have talked to a lot of people. I gave a one-hour speech, a special order on the Floor of the House, about six weeks ago, and I have had a stream of people through my office and calls from all over the world, and I know of nobody out there who doesn't believe that we are either at peak oil or will shortly be at peak oil. By the way, if you look at the curves, at the bell curve, Hubbard's curve for the world, and if you look at the use curve, you don't have to be at peak oil to have a problem, because you start deviating from that bell curve a bit before you get to the peak. So peak oil may be a bit in the future. But if the world can't

meet its demands—there are two things that we can not argue with. Hubbard was right about the United States, and we have known he was right for at least 25 years; and we in the United States and we in the world have done nothing, zilch, while this tsunami was approaching. And the other thing, which is undeniable, is that today oil is over $50 a barrel. I was talking with John Dingell, who has a broader, longer vision of this than anybody else. He has been in the House 52 years, I think. John says, "You will never see $50 a barrel oil again." Goldman Sacks says it is going to $105 and Americans won't change their driving habits until gas is $4 a gallon.

What are you doing in the Department of Energy that is consistent? Then my five minutes is up. We will come back. I don't want to take the other people's time. I want to come back. I will stay here to talk with you after everybody else has—but I want to know what you are doing that is consistent with the reality that we are probably at peak oil. See, I don't see us doing anything as a culture. I don't see us doing anything as a country. I don't see us doing anything as the Department of Energy that is consistent with this reality.

Let me yield now to the next person in the cue.

Mr. Green.

Mr. GREEN. Mr. Chairman, I will pass at this time. Thank you.

Mr. BARTLETT. Okay.

Mr. Hall.

Mr. HALL. Mr. Chairman, I thank you. And I don't know if I have a different outlook that you have. I think we are pretty close together, but we just passed an energy bill. Someone is doing something about it. This committee has done something about it, because this committee had some input into the energy bill, H.R. 6. Most of you on this committee—some of you voted against the energy bill every time it has come up. But I think energy is the number one word in the dictionary, and if had a child that was a junior or senior in high school, I would be thinking along the way I thought back in 1941 when Frank Roosevelt said, "To some generations, much is given. Of some generations, much is expected. But this generation has a rendezvous with destiny." That rendezvous was World War II, and for those who are sophomores or juniors or seniors in high school, like I was in 1941, they have the same rendezvous if we don't solve the energy problem. And we have just passed a bill that has done something about it, if the Senate will get off of the you-know-whats and give us two more votes, we will have a good bill to take to a President that will sign it. And I think everybody at that table has had some input into that energy bill, because you have been consulted. Your divisions have been consulted. You have worked with us. You have disagreed with us and agreed with us. We have a good Chairman that has been fair with democrats and republicans alike as we labored through that bill. And we have fossil fuels in the bill, and I am glad we have fossil fuels in the bill. I am glad we have anything in there that might keep my grandchildren from having to fight a war. And that is really what the reward is for solving the energy problem. It is a shame that we have to buy 60 percent of our energy from people who don't like us, who don't trust us, and people we don't trust.

It is a shame that we can't drill ANWR, 19 million acres and tell me we can't drill on a couple or three or four or five thousand of it. It is outrageous, I think, if we can't if a generation is at risk. And that is absolutely what the situation is.

So we need to clean up fossil fuels, but it is not like the Kilgore oil fields 30, 50, 45 years ago. There is a lot of good technology. The animal life in Alaska have not faltered standing in the shade of some of these oil derricks up there. We are solving a problem that is a national problem that we have the ability to solve and that we ought to solve, and that is passing this energy bill.

Now I have a part of the energy bill, and I am for every bit of that energy bill, everything that might keep our kids from having to cross an ocean and take some energy away from someone. And let me tell you, nations will fight for energy. I don't think there is any question that Japan went south into Malaysia because they had been cut off from their energy. I don't think there is any question that we—the—even went into the oil fields because they spent theirs on mixed benzene, non-benzene. They were out of fuel. George Bush sent 450,000 youngsters to a desert, and to me, that was for keeping a bad guy, Saddam Hussein, from getting his foot on half of the known oil reserves in the world. I think that was an energy battle. Of course, they envision it as liberating and giving freedom. And I respect that, too.

So I have this question. I am concerned about the cuts to oil and gas R&D in this year's budget request at a time when our nation is experiencing record energy prices and threats from abroad. We need to do more to discover new technologies to use for domestic productions, including fossil fuels and including nuclear and including solar. We have touched the base on all of them.

The energy bill that passed the House last week contains my provision that calls for mandatory spending for an ultra-deep water and unconventional natural gas production program. This program is expected to yield natural gas supplies at 3.8 trillion cubic feet and 850 million barrels of oil. According to the Bureau of Economic Geology at the University of Texas, this program will yield a net federal budget benefits of $12 billion over 10 years. It is going to cost $2.1 billion over a period of time, but it is going to yield $12.4 billion over 10 years and lower the cost of household natural gas bills by $2.2 billion per year by 2015, we are told by a study group. And that study has been accepted by republicans and democrats. It has been accepted by the House, and it has been accepted by the Senate, because it has passed the Conference Committee over there twice. And it is over there now for them.

So the ultra-deep drilling is only one promising program, and it is complementary to the base program. At this time, domestic oil and gas production is declining and the 7,000 independent producers are producing about ¾ of our domestic oil and natural gas. So my question, I guess, is why it seems to me, and I hope I am wrong because I support the Administration, but why are they determined to terminate programs that primarily benefit independent producers who are producing ¾ of our energy? And they used to produce 90 percent of it, and then the majors took it over and bought it. But that is—I guess the treatment that the independent producers are getting right now is the thing that surprises me

more than any other. Would any of you care to comment on that? Maybe I am wrong. I am not asking you to call anybody an idiot, because I have got my own mind made up as to who is an idiot.

Mr. MADDOX. Well, thank you for that.

To somewhat answer your question, though I am not certain it is, I think, as you know, it has been a very tough budget year for all of us, and we have had to make some really hard decisions. And I think the President probably summed it up best in a statement last week that with the current price of oil and comparatively well profits that he strongly believes, the President strongly believes, that industry should step up to the plate and that there is plenty of incentive for them to do so.

Mr. HALL. Probably my time is up.

Does anybody else have a—any suggestion?

Well, one, two, three, four, five. I think four of them must agree with me, and the other one is not far off, so I would yield back my time while I am winning.

Chairwoman BIGGERT. Thank you.

Maybe your question was too tough.

Mr. HALL. Well, maybe it was.

And I yield back my time, Madame Chairman.

Chairwoman BIGGERT. Thank you.

Mr. HALL. Thank you.

Chairwoman BIGGERT. The gentleman yields back.

The gentleman from California, the Ranking Member, Mr. Honda, is recognized.

Mr. HONDA. Thank you, Madame Chairwoman.

This is a question for Mr. Faulkner.

Probably more than any other program at DOE, the success of your program depends on getting taxpayer-funded technologies developed at the labs into the marketplace. Yet we hear over and over about the so-called Valley of Death where federal support for commercialization is where technology ends but that technology may not be mature enough for the marketplace. The marketplace is not always the best judge of technological winners and losers.

So I have a four-point question. If—number one is how has it the Department improved this technology transfer efforts. Is there a central body responsible for ensuring potentially beneficial technologies to make it into the marketplace? If not, will the Department and the country benefit from greater emphasis of bridging the Valley of Death for potentially revolutionary technologies? And then do other agencies' efforts, such as DARPA in the Department of Defense, serve as a good model for increased technology development and deployment? The reason I ask is I have got a bill I am working on.

Mr. FAULKNER. Well, let me try to answer those four questions——

Mr. HONDA. I appreciate it.

Mr. FAULKNER.—in a comprehensive way.

I think it is important to see this as a continuum from the first idea that somebody has to the time a consumer or an industry purchases or uses this technology. And I think the Department, and not just my office, plays an important role in several points along that continuum. It is a huge and complex process, as big and as

complicated as the U.S. economy. I think the Department, first of all, does basic and applied R&D and many times, at least in my office, we tend to do that on merit-based, competitive solicitations where the best ideas float to the top. You do that in partnerships with the private sector, cost-shared partnerships. So they are putting money on the table, and when they do that, that means they are starting to pay attention to it, and they will try to take that to the marketplace.

I think that these technologies, then, can be encouraged or promoted by State or federal legislation, State or federal tax incentives or regulations like renewable portfolio standards or renewable fuel standards. About 18 states have RPS now.

DOE also serves a regulatory function. In my office, we have an appliance standard setting operation where we set a floor for energy efficiency levels for consumer appliances.

I think, third, we build partnerships with groups like EPA on ENERGY STAR, which, in terms of consumer goods, it is kind of a voluntary upper limit that pulls the technology up into the marketplace.

Fourth, I think you have to have a very aggressive and comprehensive communications and outreach effort to tell consumers over and over again about energy-saving tips. For example, inflate your tires to the right pounds per square inch or the energy saving steps you can take in your own home. The easy things to the hard things. And you could buy ENERGY STAR appliances. In these ways you can reach millions of consumers.

And fifth, I think the Department has to work better with other federal agencies. For example, we spend a lot of time building bridges with the U.S. Department of Agriculture. They have a rural development program with millions of dollars in terms of grants and loans and loan guarantees where they are following for the first time ever an energy title from a farm bill. That title instructed USDA and DOE to work together to get some energy-saving and renewable energy technologies into the rural marketplace.

So it is a collection of things that the Department, the private sector, state and local governments can do together. It is a lot of pieces along that technology continuum to move from an idea to the marketplace.

Mr. HONDA. To the Chair, if I may, I heard what you are saying, and it sounds like you describe what actually exists right now. But there are folks still out there in the community that still recognizes this gap, the Valley of Death gap. That is what we call it. And it seems to me the government has a role in—to play to help some of these technologies to go a little further along until the private sector feels confident that that technology can be commercialized.

And the question again is what Department—what part of your Department or what functions does the Department play in terms of helping the technology transfer? Or is there a need for another piece there to make that transfer seamless?

Mr. FAULKNER. Well, ultimately, I think it is the private sector. It is the companies that will make or produce a product and sell something for a profit that gets it into the marketplace. I really believe that the key to all of this is building partnerships to do research and development and you move it along this continuum.

And if the private sector is putting money on the table with you, sharing the costs from basic research to demonstrate they are going to pay attention to it, and they are going to have an incentive to pull these things into the marketplace. That is not to say the government has no role. I was trying to describe briefly that we do have a role. Setting standards for appliances, for example can do a lot to get, you know, that the—that can start the more of these technologies into the marketplace. I am going to be buying soon an air conditioner, one step above the new standards we set, and a new energy-efficient furnace. And I think if consumers do that, as they replace equipment in their homes or companies do that——

Mr. HONDA. I guess I will be more specific.

In the area of nanoscale activities, the length of research is going to be much longer and much more complicated, and it is going to be—there is going to be more need for government-private partnerships to move the technology and the research for it closer to commercialization where the private investors are able to see the light at the end of the tunnel, whether it is, maybe, three years or four years out. Beyond that, you know, there is some issue around confidence or there is an issue around whether they will be able to sustain that kind of investment. It seems to me that we have some sort of responsibility, not unlike when the Internet was first developed.

Is there a way or is there a need for further—a closer look at this kind of activity between government and the private industry to help this kind of massive research reach closer to commercialization on the market?

Mr. FAULKNER. Well, in terms of the nanotechnology revolution, I would leave that to my colleague, Dr. Orbach, whose office works on that more than we do. But I——

Mr. HONDA. Okay.

Mr. FAULKNER. I don't see a need for that. I think we just need to do more of partnerships building, which is a pretty tough thing to do, and focus on working more with the private sector.

Mr. HONDA. Dr. Orbach.

Mr. KOLEVAR. Congressman, if I can add a point to the issue.

You mentioned your concern about the Valley of Death for revolutionary technologies. And it is an important question, and it doesn't just pertain to revolutionary technologies. I mean, it pertains to the short-term technologies. I have been in this position now for 10 weeks and have gone through and looked at a number of the R&D efforts underway and have identified some where we have worked, whether in cooperation with industry or labs, to develop some really intriguing and promising short-term technologies that benefited the fringe. I mean, they are not revolutionary. But getting them out of the lab and into industry, it is very difficult. And there are a number of challenges that change with the industry that you are looking at. I mean, most of them are just trust issues and how much money are they going to have to expend on this and are they sure that it will be successful, and do they have to worry about it interfering with their current systems.

My own sense is there is not going to be a standard model that will apply across the board. And so it will take a constantly—in my opinion, a constantly evolving effort that will be different for the

types of research that are being done by offices, whether represented at this table or elsewhere. But it is absolutely crucial, because to the extent that the Federal Government is investing money in this R&D and that it somehow stalls in that Valley of Death, it is about as close to wasted money as it can be. Perhaps the technology could be picked up at a later date if somebody finds value and finds a way to commercialize it, but just in my look, it strikes—it has been very frustrating to identify some promising, near-term technologies that were not done, you know, whether by industry or the labs or by the government, with a sound enough road map in mind. And for that reason, we are not going to see commercialization in a time frame where we could have, and therefore, we will not realize the benefits of those.

So the point you raise, in my thinking, is absolutely crucial. My response would be it is very hard and it probably is not a set model across different applied R&D programs because of the constituencies and the interest groups with which they work. It is probably going to have to be modeled differently each time, and to really follow on what Doug Faulkner said, it will have to be a strong, public-private partnership, not just the Federal Government and industry, but also, you know, states and other interested bodies, academia as well.

Mr. HONDA. Yeah. I don't disagree. And I think that the partnership needs to be there so that no one person or no one group chooses winners and losers. That is the one. And I believe that the concept—maybe conceptually you can create an approach that morphs itself according to the needs that you are looking at.

Thank you, Madame Chair.

Chairwoman BIGGERT. Yeah. The gentleman's time has expired.

The gentleman from South Carolina, Mr. Inglis, is recognized.

Mr. INGLIS. Thank you, Ms. Chairman.

I am very excited about cracking water and creating hydrogen and moving toward energy independence. But it also seems we need to crack some solutions relating to storage and distribution of hydrogen.

What kind of research should we be doing to get toward cracking those solutions, getting those solutions on storage and distribution?

Dr. ORBACH. If I might respond to that. You have identified some of the major issues facing the hydrogen economy: production, storage, and fuel cells. And here, the Department is working as a team with the Office of Science and the Energy Efficiency and Renewable Energy to address those issues. We have had a major workshop last year where we focused on the three areas you identified, and we are using the modern tools we have to address them. These would include better catalysts to lower the temperature for the cracking process you talked about.

Mr. INGLIS. Right.

Dr. ORBACH. We also are looking at open structures that we can artificially create for hydrogen storage with just the right amount of absorption. And finally, in fuel cells, we are looking at new materials that will be cheaper and more efficient in terms of the membranes that are essentially the biggest hang-up right now for fuel cell operations.

So all three of them have come together in an integrated program between our two offices. We are, as I said before, going to award about 70 grants that are in those three areas. They are, by the way, in universities, National Laboratories, and industries. There is a broad spectrum of interest in just those areas. And those grants will be awarded next month as a consequence of a competition where we had over 800 preproposals. We probably could have supported twice as many grants and maintained the same level of quality.

So I think you are going to see some, what I would call, revolutionary steps in addressing those three areas as this research program develops.

Mr. INGLIS. And by the way, we hope to get you more money to fund more of those grants, because it seems to me it is essential. We also hope to—that the energy bill is improved with Senate language that eliminates some of the earmarks on some of those things so that we steer the money to where it is actually going to get some results rather than through the political process.

And anyone else want to add something about what kind of research we could be doing, what we should be doing to get after these things of storage and distribution?

Mr. KOLEVAR. Well, I am sorry, Congressman, when you are talking storage and distribution, I guess, are you—are we talking about fossil resources, gasoline, or are we talking hydrogen in particular?

Well, the—I think I will defer to Doug, who obviously has developed that with his office.

Mr. INGLIS. Yeah.

Mr. FAULKNER. I think Dr. Orbach hit most of the main points. One other thing I would note is we are also looking at, between our two offices and other parts of the government, on the bio-refinery, the equivalent of the petrochemical refinery. I think the biorefinery will play a role down the road in this whole hydrogen revolution that is unfolding. A biomass refinery, which could take any number of feed stocks and then produce fuels and power and different chemical products, possibly including hydrogen. I think that is something else to think about as we move down the road, which would also have an impact on rural economic development.

Dr. ORBACH. And also, we are looking at biological microbial production of hydrogen. There are microbes that do produce hydrogen. They are rather inefficient, and we are currently in—exploring genetic engineering to try to increase their efficiency so that we can do this in a natural environment.

Mr. INGLIS. It is very exciting. And of course we are excited about it in South Carolina, because in—the Savannah River Site now is a National Lab, and for 30 years, we have been dealing with hydrogen under pressure. It is just that ours is radioactive, so ours glows in addition to dealing with it under pressure. We have had real reason to keep it under pressure. So because of that expertise, we want to be helpful in developing some solutions to the storage and distribution part of the equation as we move toward a—energy independence with a hydrogen economy.

And it is, in my opinion, a very bright future. And I hope that you will continue to call on us at the Science Committee and at this

subcommittee and at the Research Subcommittee, which I Chair, to help crack those challenges and get on toward this.

So I thank you for the work you are doing.

Chairwoman BIGGERT. The gentleman yields back.

The gentleman from Texas, Mr. Green, is recognized for five minutes.

Mr. GREEN. Thank you, Madame Chair.

And thank you to the Ranking Member, as well.

I would like to thank you for initiating this hearing regarding the fiscal year 2006 budget request for the Department of Energy's civilian research and development programs.

I would like to address a question, if I may, to Mr. Kolevar, and I trust that I have pronounced your name correctly, sir.

Following the northeastern energy grid blackout in 2003, a lot of attention was focused on securing our electrical grid systems, and I might add, a lot of consternation was created in the minds of many people in the country at that time. I am understanding that the Office of Energy Delivery and Energy Reliability, known as OE, is the lead—is taking the lead in modernizing such efforts with a request of $96 million, approximately, I believe $95.6 million, to be more specific. And I am concerned about two aspects of this: the GridWise and the GridWorks initiatives. I would like to get some understanding as to what you estimate the budget to be, the breakdown. Will there be additional needs that we will have to confront as we move forward? And generally speaking, where are we with these two initiatives?

Mr. KOLEVAR. Thank you, Congressman.

The fiscal year 2006 request for the two programs combined is $10.5 million, $5.5 million of that for GridWise. The overall number, $10.5 million, is consistent with the Administration's request in fiscal year 2005. The projects I think, as you know, are different but symbiotic. GridWise is really the brains of the infrastructure. It is mostly software systems designed to monitor and relay information faster and better. GridWorks is the infrastructure behind it: improved cables, conductors, and the like.

Those two projects—well, I should say, those two headers encompass a lot of projects within. And I think we are very able—very effectively able to leverage the federal dollars with work that is ongoing in the labs and in the universities. We have strong partnerships with a number of universities across the Nation on both of these elements. And I was in Atlanta last week and saw a peer review for the GridWise project and was very impressed by a number of technologies that have emerged from there that allow operators to see more clearly what is going on, not just within their system, but within neighboring systems, which is absolutely key to preventing a 2003 type blackout.

And then on the GridWorks type of work, actually, while I am here, back in—at the Department, we have a number of technology experts from across the lab complex and some universities engaged in a review of the projects that we fund through that program right now that really give a better sense, as we move forward on the 2007 budget development, as to which ones are really the most effective and where are we getting the best use, the most return, on our federal dollars, where are we, candidly, not getting a return on

our federal dollars. Are there programs that we should see, you know, moving to an off-ramp so that the resources can be better spent on others that seem to be much more promising?

The—both programs, I have to say, I have been very impressed by the quality of the work, whether it is, you know, a lab application or a university application. And I do think that much of this work we will start to see penetrating in the commercial sector in the next several years.

Mr. GREEN. Thank you, Madame Chair.

I yield back the balance of my time.

Chairwoman BIGGERT. Thank you.

The gentleman from Michigan, Mr. Ehlers, is recognized for five minutes.

Mr. EHLERS. Thank you, Madame Chair.

And I apologize for missing much of the meeting, but I had a markup in Transportation, which I was offering a very, very good amendment, and I thought my——

Chairwoman BIGGERT. I assume that it passed then?

Mr. EHLERS. Yes.

I—you gentlemen at that table represent, in my mind, just about the most important group of people in this country at this point, because I am convinced that we absolutely have to reduce our dependence on foreign imports of energy. We have to do a much better job of using our energy. And I am not alone in that thinking. And many times, I have met people who regard this as sort of a fuzzy-headed, knee-jerk, liberal idea that we have to improve our energy efficiency, but I am very pleased the Energy Future Coalition has developed a plan they called "Set America Free: A Blueprint for U.S. Energy Security" has nothing to do with environmental considerations. It has everything to do with national security considerations. And these are by very knowledgeable people.

I think it is clear that we can save—we can improve our energy supplies far more and far more cheaply through conservation and efficiency than by any other short-term means. And so I was disappointed that the President's budget—or the Administration's budget suggests cutting buildings R&D programs by 11.5 percent. Buildings account for almost 40 percent of our energy consumption, and we ought to be working very, very hard on that and not cutting the funding.

The American Council for Energy Efficient Economy has noticed that very small changes in demand for energy can result in much larger drops in energy prices, and I know my natural gas heating bill has doubled in less than a decade. I would very much appreciate very strong efforts to reduce the use of natural gas. I think it would be very beneficial for the economy if the price of natural gas dropped.

Also, we need better efficiency in transportation, which is another huge—I believe it is 25 percent of the use. And again, if we can do that, the price of oil will drop.

Can you assure me that you—the Department of Energy is—and I apologize for your budget cut this year. I think that is disastrous, and we will try to reverse that in the Congress or change it, but can you assure me that the Department of Energy is really putting full effort into achieving these efforts, going in the direction of en-

ergy independence by energy conservation, and above all, energy efficiency?

Mr. Faulkner.

Mr. FAULKNER. Yes, sir.

I think I will make a couple of points.

Our budget is still about ⅔ to ⅓ weighted toward energy efficiency over renewables. We have a lot of different priorities in our office. I mentioned earlier in my oral testimony that we are proud, and take pains to defend, the balance and the diversity in our portfolio. I think the building sector is an important one. You are absolutely right. And it is not just the R&D. It is also looking at setting the standards for appliances, which will help boost the energy efficiency of the marketplace.

I would also note that Chairman Greenspan, in a recent speech, talked about the incredible success story of how the energy use per GDP in the economy, since the 1970s, has shown a steady drop, a continuing drop. Part of that is, of course, due to R&D, but I think part of it, as he noted, too, is due to the cost of energy and what that does to businesses, their incentive to reduce energy use and home use. And also I think we have to do a better job, and continuing to do a good job, of educating the public, getting that word out about how you can use better energy-efficient appliances, how you can do things in your home that are simple-to-complex, cheap and expensive.

Mr. EHLERS. May I just interrupt there for a moment?

I think that maybe the most important thing you can do, and I have always admired Agriculture, through their cooperative extension service, what they discover in the lab one year is used in the fields the following year. However, in energy efficiency, just as an example, I—when I was at Berkeley, they developed the energy-efficient windows. It took 20 years for that energy to be used in a big way in the field. I mean, whatever you can do to get that word out through setting up a cooperative extension type of arrangement, the public is woefully ignorant about energy I think primarily because it is intangible. They don't—they can't see it, touch it, feel it, smell it. They don't understand it. And so you have real educational job to do.

Dr. ORBACH. And I would also like to add that there are tremendous opportunities, inefficiencies that you identified. One of them is in the white light solid state lighting. About 20 percent of our electricity is used for lighting. And the incandescent bulb is about five percent; fluorescent is about 25 percent efficient. With solid state lighting, in the white, natural light, we can get those efficiencies up by factors of two, at least.

Mr. EHLERS. Right.

Dr. ORBACH. And so we are working very hard on developing new light sources that are solid state to try to reduce the energy consumption.

Mr. EHLERS. And did you have any projections of the price?

Dr. ORBACH. Well, right now, I think—I have forgotten the fraction, but a significant number of traffic lights are solid state. You have seen them by the little round dots. They save $1,000 per year per intersection. And our estimate, very roughly speaking, is if we could replace incandescent and fluorescent lights with solid state

lighting, we could make the equivalent of creating 50 new nuclear power stations in the United States in terms of savings. So there is a huge opportunity there. And indeed, industry and our own research are working hard on that.

Mr. EHLERS. I thank you very much.

And I will yield back, since I have used up my time.

Chairwoman BIGGERT. Thank you very much, Mr. Ehlers.

The gentleman from Illinois, Mr. Costello, is recognized.

Mr. COSTELLO. I thank the Chair, and I thank the Chair for—and Mr. Honda, the Ranking Member, for calling this hearing today.

And I just want to apologize, as my friend from Michigan did. I was in the same markup, and I want to attest to the fact that he did offer a very important amendment, and hopefully we are going to deal with that issue at some time in the not-too-distant future, because I think you are right on point.

Mr. Maddox, it is good to see you again. We have met before, and we have talked about the FutureGen project that the initiative that the Administration is supporting, and I had an opportunity to meet with the Secretary of Energy recently where he reconfirmed the commitment on the part of the Administration and the Department of Energy to move FutureGen along. And I first want to commend both President Bush and the Department of Energy and the Administration for their strong support for FutureGen. I think it is important for the future of this country.

The—as you know, the entire Illinois delegation, including this speaker and all 19 Members of the House and both of our United States Senators, have sent a letter to both the President and the Secretary supporting FutureGen. I know that Congressman—my colleague from Illinois, Congressman Shimkus, and I recently, not too many months ago, met with you and presented petitions by over 10,000 residents in southern Illinois supporting the project, and they are hopeful that, not only that the project will go forward, but also that the project will be built in Illinois.

I wonder if you might give us an update as to the progress that has been made by the Department moving forward with FutureGen and then give me a timeline as to your objectives and some of the things you want to achieve by specific dates.

Mr. MADDOX. Thank you very much, and it is good to see you again.

I can confirm your statement that the folks in Illinois are in full voice on this issue, and we hear from them on a very regular basis.

I would just say, right now, I am probably the most optimistic and confident FutureGen will go forward at any time since it was first initiated by the President. We have given the private sector the confidence that the Federal Government will meet its commitments on funding going forward. We—they have joined us in negotiations. Those negotiations are going forward really on two tracks: one track on the legal agreements, but also a separate track on NEPA issues in order to try to move quickly on the NEPA issues. Our expectation or our hope is if we can get an agreement done by mid-summer, that some time in the next three to six months, we can put out an initial request for interest for siting locations.

And additionally, the confidence, from my standpoint, has reached a point where a recent trip to China, I did formally ask the Chinese government to become a part of this FutureGen. I have also approached several other governments, and that is becoming one of my priorities now is to go out and start soliciting international partners to become—to join FutureGen as well.

So as I said at the beginning, I am very confident, and that, I think, gives you a rough timeline of some of the critical issues of where we are now.

Mr. COSTELLO. The—my understanding is the consortium, the partners, have come together. There was a meeting in March, as I understand. What is the next thing for them to do? Will they be meeting again? Is it scheduled? What do they need to do?

Mr. MADDOX. We have actually had three meetings. I am not real certain when the fourth is scheduled for. And I am not certain how much of it—I am not directly involved in negotiations. A lot of those are procurement issues and procurement-sensitive, not to be sworn in and various other issues. I know they are meeting on a regular basis, and that is kind of the status I can give you on that. But I have asked repeatedly, "Are there issues that look like showstoppers?" and have been assured there are none.

Mr. COSTELLO. I know that you are not in a position to give us a definitive date, but you have noted that you are more optimistic now than you ever have been that the project is going to happen. Do you think that we will be at a point some time this calendar year to make a judgment as to narrowing it down to site selection?

Mr. MADDOX. I think it will be at a juncture this calendar year where we will have asked everyone who is interested in hosting the FutureGen project to express interest and begin that process of winnowing down by the end of this calendar year.

Mr. COSTELLO. I thank you. And again, I thank the Administration and the Department of Energy for your strong support. It is an important project. We, of course, hope that it is built in Illinois, but even if it is not built in Illinois, it is an important project. We have a 250-year supply of coal in the United States. We need to figure out a way to burn it in an environmentally-safe manner, and this project will, in fact, move us forward to doing that.

So I commend you, and I want you to know that if there is anything that we can do as a delegation to assist you, please don't hesitate to call on us.

Mr. MADDOX. Thank you very much.

Chairwoman BIGGERT. The gentleman yields back, and that concludes our first round.

I think we will have a second round, if we can do it very briefly.

I have two questions. I had three, but, fortunately, Dr. Ehlers asked one of them, so maybe I can get these two within this time with a short question and short answers.

First of all, for Mr. Johnson, as was mentioned in my opening statement about the President coming forward with the—proposing for new nuclear facilities. Do you think that the U.S. industry will—is willing to participate in the large-scale research efforts?

And secondly, I just returned from France and the Netherlands looking at reprocessing plants, nuclear plants there. And it is something that we have developed here in the United States and in Illi-

nois and has—you know, has—was shut down quite a while ago, but this is the—to me, is the way to go as far as how we are going to deal with nuclear waste and also how we are going to conserve the energy which we are now—so much of the nuclear energy we are just putting into the waste rather than reprocessing, will that be part of this proposal? Sorry.

Mr. JOHNSON. Thank you, Madame Chairwoman.

With respect to the industry support for our Nuclear Power 2010 program and moving forward on a path that will hopefully lead to a decision by industry to go forward with a new plant order and the construction of a new nuclear plant, we have been pleasantly surprised with the support of industry and the enthusiasm across the industry. We do have, we believe, two very strong industry utility-led consortia who are pursuing our regulatory demonstration project with us at this time: the Dominion-led team and the new ENERGY STAR. They are clearly serious about this, more so—for the first time in a long time, and we hold out a great hope and promise. If our second phase here on our combined construction operating license demonstration project is anything like the experience that we have gained over the last couple of years with our early-side permit projects, this program will continue to be a success.

With respect to your question on—the question of reprocessing overseas, whether in Europe or Japan, as you know, the Department is pursuing looking at the separations technology for spent nuclear fuel as part of our Advanced Fuel Cycle program. Our focus in that program is looking at how can we safely, securely, in a proliferation-resistant manner, treat the spent fuel that is produced from the current fleet of operating reactors. We are looking at that, both from a separation of the spent fuel constituents point of view and also refabrication of those spent fuel constituents into new fuel to be recycled back into either existing reactors or possibly in the Generation IV fast reactors that we are currently pursuing.

Chairwoman BIGGERT. Thank you.

Well, now I have got three questions here.

Dr. Orbach, they are both for you, and you probably would expect me to ask both of these, but given the limited funds, many in the fusion research committee have told us that the United States should drop its participation in ITER if it would require deep cuts in funding for domestic programs. Do you agree with this?

Dr. ORBACH. Yes, I would, because the strong domestic program is critical to the success of ITER and to the success of the United States in participation. In the 2006 budget, we have had to reduce, somewhat, the domestic program, but I would like you to look at that in terms of a reorientation of the domestic program rather than a reduction. ITER itself is an experimental device. It will be the largest experiment ever conducted, and we believe that the intellectual opportunities there are enormous. And——

Chairwoman BIGGERT. But we have put so much into that—into this budget for this year, and there isn't even a site yet, be it France or Japan.

Dr. ORBACH. Well, we hope that by July there will be a site decision. Both parties, the European Union and the Japanese, have

stated publicly that they hope to reach a decision between themselves by July.

Chairwoman BIGGERT. Okay.

Then this question you probably know that I would ask. And I save the best for the last.

There—you know, the Rare Isotope Accelerator is an important project for nuclear physics and for the Nation. And is it still a priority for the DOE and the Office of Science?

Dr. ORBACH. The answer is yes. It tied for third in our 20-year facility outlook. Secretary Bodman has written that it is a very important scientific program, both for nuclear physics and also national security. And our problem, of course, is that currently we do not have a funding structure for it, and so we have withheld the—request for proposals.

Chairwoman BIGGERT. Well, what is the status of the NCAC review?

Dr. ORBACH. We believe that the NSAC review——

Chairwoman BIGGERT. I mean NSAC.

Dr. ORBACH. Yes. It is the Nuclear Science Advisory Committee review. They—we are hoping to get a response from them by June.

Chairwoman BIGGERT. Okay. So there is no funding, but the—but perhaps a placeholder?

Dr. ORBACH. Well, we have R&D funding in the 2006 budget. There is $4 million, which is a continuation——

Chairwoman BIGGERT. Which is the placeholder.

Dr. ORBACH.—of the R&D, and that is because it is an important project for us. And we don't want to let go of it. That money will be well used for the development of the project itself.

Chairwoman BIGGERT. Okay. Thank you.

Mr. Honda, do you——

Mr. HONDA. Thank you, Madame Chair.

To Mr. Kolevar, I have been meeting with some folks and their municipal utilities, and there were some concerns about how costs are driven up because of, I guess, routing of electrons and the distribution of it and how they are managed or manipulated. And I was just wondering what role that you could describe for us, the role of the electric utilities and the development with DOE of real-time monitoring and the control software tools and system operating models that are at the core of your transmission reliability and distribution R&D programs. I am trying to understand a—what appears to be a very complicated management of electrons as it relates to cost and passing costs onto consumers, whether the utilities or the municipalities. I am having a—I would like some help in understanding that.

Mr. KOLEVAR. Sometimes I like help in understanding it.

It—I think, clearly, 50 years ago, if people had been asked, you know, "We are going to start fresh, and what is the grid going to look like?" we probably would have had a different design than we had today. I don't think that would surprise anybody. But the nature of the market, the nature of the fractured jurisdictions, competing companies are often very reluctant to share market data and proprietary data, because it can affect their bottom line, dramatically impacts the costs that end-use consumers can face, even when they are within a relatively small area. And it is a challenge.

It—my office addresses it and comes at it in two ways. One, of which you mentioned, is technology development along the lines of monitoring systems, aggregating data to really find, you know—to get where the energy is flowing efficiently and probably with some capability in the future to identify costs, where costs are being allocated along various lines. The second side of our office's work on that is on the analytical side, and it is working with municipalities, with regional organizations, with states to identify future goals with respect to development to identify constraints within the system. You know, a lot of times you have, in a lot of regions, the ability to produce more energy but not really push it along to end-use consumers, because you have, you know, constraints. Path 15 in California is one notable one, probably notable because we fixed it. It took a long time to do.

And so it is a difficult challenge. My sense is that it will be driven—that reforms in this area will be driven by the passage of effective, comprehensive energy legislation. And in my opinion, the House's actions with the bill that passed out recently will go a long way towards helping, and it will be because we have systems in place to encourage the development of regional entities, who don't necessarily have a profit margin or a profit motive at the end of the day. They have the interest of the consumer at their heart. And empowering regional entities to work within states or within several states will go a long way toward helping level the sometimes very differing cost scales within regions for price.

But I will tell you, on the technology side, we have some very promising R&D projects that we are pursuing that are—that I—that are starting to see commercial penetration that are—that have the potential to have a cost impact and that you can start to trace, you know, who is paying for what along various lines, but also have a huge—can have a huge impact on reliability in that you—in that operators and operators' neighbors would be able to see fluctuations in the grid that might precede a low-voltage event, a brief blackout, or what could actually cascade into a big blackout and respond very quickly to correcting that frequency change and thereby increase reliability for consumers. And at the end of the day, the country loses a lot of money from blackouts, probably ⅔ of it from your very momentary blackouts. You know, you get home and your alarm clock is blinking. That kind of blackout is a minor inconvenience to you and me. We go home and we reset our alarm clock. It is a major inconvenience to somebody like Intel who can lose an entire chip-line from, you know, a 10-second occurrence.

Being able to address those brief occurrences, those brief outages, and increase the reliability of the system will save the Nation a great deal of money in the future.

Chairwoman BIGGERT. The gentleman yields back.

Before we bring this hearing to a close, I want to thank our panelists for testifying before the Energy Subcommittee today. And I would agree with Dr. Ehlers that you and your agencies and your testimony and your expertise are so important to the field of science, especially research and development, and to this Nation and to the global economy that we live in.

So I thank you so much for being here today.

If there is no objection, the record will remain open for additional statements from Members and for answers to follow-up questions the Subcommittee may wish to ask of the panelists. Without objection, so ordered.

This hearing is now adjourned.

[Whereupon, at 12:45 p.m., the Subcommittee was adjourned.]

Appendix:

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Raymond L. Orbach, Director of the Office of Science, Department of Energy, Washington, DC

Questions submitted by Chairman Judy Biggert

Q1. Last year, you testified that the U.S. contribution for ITER would be about $700 million. We understand that you now consider that figure to have been in error and are not sure where it originated. What is the current estimate of the U.S. contribution to ITER? Will the U.S. contribution be capped at that level? Are there any circumstances under which you can envision that cap being breached? What additional costs beyond the contribution to the ITER project itself do you expect the U.S. will incur as a result of its contribution to ITER?

A1. The current estimate originated with the $502 million value estimate, corresponding to our 10 percent of the ITER Engineering Design Activities Final Design Report estimate, and has been revised to reflect guidance of the DOE 413.3 Order on Program and Project Management for the Acquisition of Capital Assets, industrial estimates by U.S. suppliers, revised rates of escalation, and best practices of DOE project and procurement management.

The current Total Project Cost (TPC) estimate for the U.S. Contributions to ITER Major Item of Equipment (MIE) project is $1.122 billion for the eight-year project period. (Note: Total Project Cost is the sum of Total Estimated Cost—the U.S. contributions of equipment, personnel, and a limited amount of cash supporting the personnel and the installation and assembly tasks, and Other Project Costs—the specific R&D and design activities that support ITER.) The TPC cap is based on the June 2003 authorization from an interagency process led by the State Department and the Office of Science and Technology Policy to negotiate the multilateral ITER Agreement. The only known circumstances under which the cap could be increased would arise from factors that are deemed to be outside the control of the DOE. For example, both economic changes causing increases in projected escalation rates by the time of the Critical Decision-2 (CD–2) review and changes in currency exchange rates affecting the cash parts of the U.S. Contributions to ITER project would constitute bases for increasing the cap.

The only additional costs that we expect the U.S. to incur as a result of our participation in the construction, operation, de-activation, and decommissioning of ITER will be the research costs associated with providing scientists, engineers, diagnostics and other associated equipment during the research phase of the experiment.

Q2. Given the reduced funding outlook for Office of Science, do you plan to revise your 20-Year Facilities Plan? How will you make the choices between building new and running existing facilities, and between facilities and funding for research grants?

A2. The Twenty-year Facility Outlook was designed to be a planning document, not a budget document. The Office of Science recognizes that the breadth and scope of the vision encompassed by these facilities reflect a most aggressive and optimistic view of the future of the Office. Nevertheless, we believe that it is necessary to have and discuss such a vision. Despite the many uncertainties, it is important for organizations to have a clear understanding of their goals and a path toward reaching those goals. We have held to the priorities listed, as appropriations and scientific considerations provide. Under the funding request for FY 2006, we plan to proceed with the priorities contained in the Outlook.

This is not just a listing of all possible future facilities which will enable the best science. The Twenty-year Facility Outlook only lists 28 facilities, and the facilities are prioritized according to the best science they will produce. The order is like a golf score: there is a first, and there is a second. But four facilities are tied for third for the simple reason that their relative order is difficult if not impossible to obtain on purely scientific grounds. These choices were made with the assistance of the U.S. scientific community. Our Advisory Panels assessed the scientific opportunities in their own fields, and set time lines when these opportunities could mature. My office then chose among fields, assigning priority according to our best sense of relative scientific importance using, of course, the assessments of our Advisory Panels.

While it is DOE's intent to give priority to these facilities, many steps need to occur before deciding whether and when to propose construction of each, including long-term budget estimates, the status of project R&D, conceptual design work, en-

gineering design work and scientific reviews, inclusion in the President's budget requests, and approval by Congress.

Nuclear Physics

Q3. When and how will the Department make a decision about the future of its nuclear physics facilities: the Relativistic Heavy Ion Collider, the Continuous Electron Beam Accelerator Facility and the Rare Isotope Accelerator?

A3. Initial decisions regarding the future of the nuclear physics facilities are expected to be made during the FY 2007 budget formulation process. As you are aware, federal funding will be constrained in the out-years. The Department will examine its activities and opportunities across its portfolio and make decisions that will optimize the utilization of the resources available to address national priorities and meet national needs. Input from the research community has been solicited through the Nuclear Science Advisory Committee (NSAC) regarding the opportunities for scientific progress and discoveries from the programs at RHIC, CEBAF, and RIA, and will be part of the decision process.

Question submitted by Representative Dave G. Reichert

Q1. How do you plan to address shortfalls in user facility funding such as those faced by Environmental Molecular Science Laboratory (EMSL) at Pacific Northwest National Laboratory? Can you commit that you will support efforts in Congress to provide additional funds for Office of Science user facilities, including EMSL?

A1. The Office of Science (SC) places great value and the highest priority on its National Scientific User Facilities. We continue to provide full support for EMSL operations, and have not reduced its budget since it opened in 1997. Through the use of science and management reviews by Advisory Committees (e.g., Biological and Environmental Research Advisory Committee) as well as by internal SC entities, we seek to balance the needs of National Scientific User Facilities and support for fundamental research programs that use such facilities. We factor the recommendations of such reviews into our decision-making process for budget development.

Questions submitted by Representative Michael M. Honda

Q1a. The existing national laboratory infrastructure represents a sizable investment by DOE, especially aging facilities for nuclear-related research.

Has the department examined how facilities that it supports may be consolidated to reduce the maintenance needs for older facilities?

A1a. The Deputy Secretary has recently approved an Asset Management Plan to establish the goals and strategies to guide and evaluate management of Real Property Assets in a holistic, performance-based approach. The Asset Management Plan and the Department's Facilities Information Management System, the dynamic repository of facility data, are key facility assessment tools.

The Department's Real Property Asset Management Order established the requirement for the preparation of comprehensive Ten Year Site Plans (TYSP) to formally integrate long-range real property asset planning with the Department's strategic plan and appropriate planning guidance. The TYSP addresses space and land use across the site to consolidate operations where practical and eliminate excess facilities. It addresses facility assets throughout their life cycle (acquisition through renewal and/or disposal) to control overall facility cost while enhancing the facilities' contribution to mission effectiveness.

Q1b. Has the department estimated the costs for decommissioning consolidated facilities?

A1b. At the Headquarters level, Decontamination and Decommissioning (D&D) costs of contaminated facilities have been estimated and are reported as liabilities within the Department's Balance Sheet.

At the site level, as noted above, the Department has established the Ten Year Site Plans (TYSP) to formally integrate real property asset planning with the Department's strategic plan and appropriate planning guidance. The TYSP addresses facility assets throughout their life cycle (acquisition through renewal and/or disposal) and considers the business case decisions for facility consolidation, renovation and decontamination/decommissioning.

Biological and Environmental Research

Q2a. What are the department's plan to ensure the long-term availability of isotopes for research, clinical trails, and treatment?

A2a. The Department of Energy (DOE) maintains nuclear technology infrastructure that supports a wide range of important research, isotope production, and other vital purposes. The planning, maintenance, and safe operation of this infrastructure is important to DOE. DOE has undertaken measures to address facility capabilities and upgrades in support of nuclear, scientific, and medical research. An example is DOE's investment in the Isotope Production Facility (IPF), a new production capability at the Los Alamos Neutron Science Center (LANSCE) that will enable almost year-round production of long-lived accelerator isotopes including many that are not typically available elsewhere. The upcoming National Academy of Sciences (NAS) study on isotope production, which will include DOE participation, will help determine future needs in this area.

Q2b. With over 17 million procedures performed in the U.S. last year, research in nuclear medicine is critical to maintaining our standard of living and extending lives.

The future of research in radioisotopes is highly dependent on the availability of skilled radio-chemists and nuclear chemists. How is the department addressing the need to retain and develop such skilled professionals?

A2b. We have started a dialogue with our colleagues at the NIH on the future of the nuclear medicine program, including the training of the next generation of radio-chemists.

Basic Energy Sciences

Q2c. What is the justification for cutting funding for the Radiological (sic) Engineering Development Center at Oak Ridge National Laboratory?

A2c. The BES portion of support for the Radiochemical Engineering and Development Center (REDC), which provides capabilities for the processing, separation, and purification of transplutonium elements, was terminated in FY 2006 because only a handful of BES researchers make use of the REDC annually. The funding was terminated in order to support higher-priority facilities that together host thousands of users annually.

Q2d. Has the Office of Science evaluated the cost associated with shutting down this facility, and has the department budgeted for such an activity?

A2d. It is not anticipated that REDC will close. SC funding for REDC had been ramping down gradually over the past two years with the expectation that ORNL would consolidate work in its many hot cells at the ORNL site into the REDC facility. Support for REDC would then come from actual users and customers of hot-cell facilities.

Fusion Energy Sciences

Q3. By increasing funds for Fusion Energy Sciences in these extremely tight budget times, the Administration has signaled its strong support for the ITER project, a critical step in the development of fusion energy. But the budget request reduces vital domestic research by $ 34.1 million, which would seriously damage U.S. capabilities to benefit from ITER. And this is at a time when U.S. fusion energy research funding is already only one-third that of Europe.

- *Should we take the Fiscal Year 2006 (FY06) budget request for fusion as an indication of how the domestic programs may have to make sacrifices for our role in ITER in the future?*
- *If not, how can we continue the world-class research at our facilities at home while still participating in the international effort?*

A3. As you have noted, the ITER Project is a critical step in the development of fusion energy, with strong support from the Administration. The ITER facility will provide a unique opportunity to investigate the complex science of burning plasma physics and technology, which underpins the feasibility of fusion as an energy source. The construction and operation of ITER leverages international collaboration to share the existing knowledge and to minimize the cost of achieving this objective. ITER is an integral part of the U.S. Fusion Program, benefiting from the ongoing research at the major U.S. facilities in theory and computation, technology develop-

ment, and U.S. collaborations with the international scientific community. The experience we will gain from the construction and operation of ITER will benefit the totality of the U.S. Fusion program. In FY 2006 we have re-oriented the program to accommodate the needs of the ITER Project in addition to established priorities. We will adjust our priorities as appropriate within the annual budget allocations and maintain a viable U.S. Fusion program to benefit from ITER.

Questions submitted by Representative Lincoln Davis

Leadership Class Computing

Q1. Does DOE intend in FY07 to resume hardware acquisition to actually establish a true leadership class computing facility?

A1. The Department is currently in the process of developing its FY 2007 budget proposal.

Q2. What are the Department's long-term plans for the leadership facility awarded last year to the team led by Oak Ridge National Lab?

A2. The Department is planning to continue its investment in the Leadership Computing Facility, which will provide a limited number of competitively selected teams the capability to achieve scientific leadership. The focus on providing a small number of teams access to exceptional capability is key to the mission of the facility.

Q3. How does this contribute to establishment of a leadership class computer?

A3. The computers being currently installed at the Leadership Computing Facility (a 20 teraflop Cray X1e and a 25 teraflop Cray Xt3 or Red Storm) are two of the largest systems available for open science in the U.S. The decision to allocate these resources to a limited number of competitively selected teams will enhance the facility's ability to enable leadership class science.

Q4. How does the Department justify the newly proposed "Research and Evaluation Prototypes," funded at $13.2 million, a "new start" in FY06 when the budget also includes a significant cut to the Center for Computational Sciences, an established program?

A4. The research and evaluation prototype activity, previously referred to as Advanced Computing Research Testbeds, has been a part of the Advanced Scientific Computing Research budget for a number of years. In FY 2005 Oak Ridge National Laboratory will complete the evaluations that were funded in prior years. Therefore, we will solicit proposals for new research and evaluation prototypes in FY 2006. This type of activity was strongly endorsed in the Federal Plan for High End Computing, which was published by the National Science and Technology Council last May. These systems complement our investments in the Leadership Computing Facility at Oak Ridge National Laboratory because they enable us to evaluate future systems. In a technology area like computing, where new computers are introduced every two years, it is critical to evaluate future systems in order to understand what systems should be installed at facilities like the Leadership Computing Facility and the National Energy Research Scientific Computing Center.

Genomes to Life

Q5. The constrained budgets DOE will face in the coming fiscal years are already affecting operations of existing user facilities.

Will DOE reconsider the scale and scope of the four Genomes to Life start-up facilities, so that the cost of each is reduced?

A5. Yes. We have recently engaged the National Academies in a scientific assessment of our current plans for the Genomics: GTL program. Among several topics, they have been asked to address the scientifically appropriate scope and scale for facility component of the Genomics: GTL effort.

Question submitted by Representative Al Green

Q1. I notice in your testimony that there is a strong focus, in terms of funding, on the President's initiatives.

How much of a role does that play in your requests for the funding of activities and have you found any major divergent visions between your particular sectors and the Administration's initiatives?

A1. The Office of Science (SC) budget funds presidential initiatives in hydrogen and fusion (ITER). The Office fully funds all of the President's initiatives, subject to Congressional appropriation, and has found these Presidential initiatives in line with the science-driven priorities outlined in SC's 20-year Facilities for the Future document.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Douglas L. Faulkner, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, Department of Energy, Washington, DC

Questions submitted by Chairman Judy Biggert

Q1. In both your written and oral testimony, you emphasized standards-setting for buildings, appliances, and equipment as a priority for the Building Technologies Program in the Office of Energy Efficiency and Renewable Energy. The program has not submitted several final rules for new and amended appliance standards that were required by the Energy Policy Act. While it is good news that several rules are going to be issued in 2005, the backlog would make it seem unwise to be cutting the budgets for this important program. Are these efforts resource-constrained? What would it take for the Department of Energy (DOE) to issue final rules in all areas which it was overdue? How is the peer review requirement recently imposed by the Office of Management and Budget affecting the standards process at DOE?

A1. We recognize the Department has missed statutory deadlines for a number of rule-makings. Secretary Bodman has testified regarding the importance of resolving this issue. We continue to undertake an annual priority-setting process to determine which of these rule-makings should be allocated resources during the coming year; we are working diligently to complete the priority rule-makings and expect to issue rules for these products as soon as possible. Our efforts are not resource-constrained; the reduced level of funding for these activities requested for FY 2006 will have no impact on these priority rule-makings. However, the process for issuing rules is lengthy and burdensome, including substantial periods for public comment that can slow the process.

To issue all final rules that are overdue, the Department would have to significantly accelerate its processes. Yet, some overdue rules are no longer of significance to industry or the public, while others are of great importance. We will continue to focus on the highest-priority rules.

We expect that the peer review requirements imposed by the Office of Management and Budget will have little impact on rule-making schedules; we will conduct the peer review of the appliance standards concurrent with the preparation and review of Notices of Proposed Rule-making.

Q2. The American Council for an Energy Efficient Economy (ACEEE) has noted that small changes in demand for energy can result in much larger drops in energy prices. They have estimated that a five percent reduction in demand for natural gas could cause a 20 percent drop in price. Your testimony refers to "the Department's focus on longer-term, high-risk activities." However, the White House guidance to agencies for research and development (Memorandum 04–23) also calls for investments that "support technological innovation to enhance economic competitiveness and new job creation." Given the large public benefits of the price drop modeled by ACEEE (around $25 billion per year), and the high energy prices today, is there a need to focus more of DOE's research and development effort on nearer-term energy efficiency goals? What contribution to our predicted energy demand could be made by an investment in efficiency and renewable energy of one-fifth of this benefit over the next three years?

A2. The Office of Energy Efficiency and Renewable Energy's (EERE) portfolio of research and development (R&D) efforts focuses on achieving a diverse mix of near-, mid-, and long-term benefits. Although near-term benefits may seem particularly attractive during a time of high energy prices, it is critical to maintain an array of technologies that will reap benefits into the future.

We have not conducted an analysis to determine the level of public benefits, including reductions in energy demand, that would likely result from increasing the budget of EERE to $5 billion over three years ($1.66 billion per year). With R&D, benefit estimation provides decision-makers with a useful indication of relative benefits rather than absolute benefits. To have a larger near-term impact, the investment should be targeted at implementing energy efficiency projects, not R&D. It is generally the role of industry to make such investments, and, absent a market failure, industry will usually do just that if price signals indicate that the projects will be sufficiently profitable.

In his 2005 State of the Union Address, the President underscored the need to restrain spending in order to sustain our economic prosperity. As part of this restraint, it is important that total discretionary and non-security spending be held

to levels proposed in the FY 2006 Budget. The budget savings and reforms in the Budget are important components of achieving the President's goal of cutting the budget deficit in half by 2009 and we urge the Congress to support these reforms. Regardless of EERE's funding level, our primary long-term goal remains to significantly reduce our dependence on foreign oil and to develop the technologies that enable Americans to make greater and more efficient use of our abundant, clean, domestic renewable energy resources.

Question submitted by Representative Ralph M. Hall

Q1. Over the years, DOE's Industrial Technologies (IT) Program has helped make manufacturers in my state and rest of the country more competitive in global markets which creating good-paying jobs. The IT program is meeting its goals of reduced dependence on foreign energy, reduced environmental impact, job growth and retention. I am concerned to find that the program faces deep budget cuts at DOE, from $91 million in 2004 to a requested level of $57 million for Fiscal Year 2006. Why is the Administration cutting back on its requests for this successful public-private partnership program?

A1. Because industry is less likely to invest in R&D toward long-term energy-savings technologies, our Industrial Technologies Program focuses on a fewer number of higher-risk, higher-reward technologies, and our budget reflects that. Fortunately, the industrial sector of the economy is already quite energy efficient, since it has an economic incentive and the financial means to reduce energy use as a component of its overall cost of production.

Questions submitted by Representative Al Green

Q1. The proposed budget seems to de-emphasize the necessity for energy efficiency and renewable energy by continuing to reduce funding for energy efficiency and renewable energy research and development (R&D), with the exception of activities supporting the Administration's hydrogen initiatives. Renewable Energy R&D funding, excluding the Hydrogen fuel initiative, has seen a 13 percent reduction and Energy Efficiency R&D (excluding fuel cells) is projected to have a 15 percent reduction. I noticed in your written testimony that the attempt is to focus "R&D on long-term, high-payoff activities that require federal involvement to be successful."

What other criteria does DOE use to prioritize its energy efficiency and renewable energy initiatives?

A1. The Department of Energy (DOE) prioritizes its activities in alignment with the National Energy Policy and the Department of Energy's Strategic Plan. In addition, DOE utilizes models that estimate the potential benefits of portfolio choices. DOE also uses principles contained within the President's Management Agenda (PMA), the Office of Management and Budget's Program Assessment and Rating Tool (PART), and the Research and Development Investment Criteria (RDIC) to inform budget decisions and guide management improvements.

Q2. The proposed budget seems to de-emphasize the necessity for energy efficiency and renewable energy by continuing to reduce funding for energy efficiency and renewable energy research and development (R&D), with the exception of activities supporting the Administration's hydrogen initiatives. Renewable Energy R&D funding, excluding the Hydrogen fuel initiative, has seen a 13 percent reduction and Energy Efficiency R&D (excluding fuel cells) is projected to have a 15 percent reduction. I noticed in your written testimony that the attempt is to focus "R&D on long-term, high-payoff activities that require federal involvement to be successful."

Why do you believe that there is such a focus on the Administration's hydrogen initiatives rather than other near-term technologies such as solar, wind, and hydropower energy?

A2. Reducing, or even eliminating, our nation's dependence on foreign oil is the top priority of the Office of Energy Efficiency and Renewable Energy (EERE). Our requested funding levels for programs that can directly reduce transportation oil consumption, such as the Hydrogen, Fuel Cells & Infrastructure Technologies Program, reflect that high priority. In addition, the FY 2006 funding requests for solar energy and wind energy are only slightly below (one percent and two percent, respectively) their 2005 appropriation levels. The lower request for hydropower reflects the De-

partment's decision to close out its hydropower R&D work in the absence of any significant remaining market barriers that would justify continued federal investment.

Q3. The proposed budget seems to de-emphasize the necessity for energy efficiency and renewable energy by continuing to reduce funding for energy efficiency and renewable energy research and development (R&D), with the exception of activities supporting the Administration's hydrogen initiatives. Renewable Energy R&D funding, excluding the Hydrogen fuel initiative, has seen a 13 percent reduction and Energy Efficiency R&D (excluding fuel cells) is projected to have a 15 percent reduction. I noticed in your written testimony that the attempt is to focus "R&D on long-term, high-payoff activities that require federal involvement to be successful."

I noticed in your testimony that there has been a strong focus, in terms of funding, on the President's initiatives. How much of a role does that play in your request for the funding of activities, and have you found any major divergent visions between your particular sector and the Administration's initiatives?

A3. As an integral component of the Administration, the Department shares the President's vision and carries out activities to support that vision, including Presidential initiatives.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Mark R. Maddox, Principal Deputy Assistant Secretary for Fossil Energy, Department of Energy, Washington, DC

Questions submitted by Chairman Judy Biggert

Q1. The President's fiscal year 2006 (FY06) budget request proposes to rescind $257 million from the Clean Coal account, and advance-appropriate the same amount in Fiscal FY07, dedicated to the FutureGen project. Such a change would move the project into an account with fewer statutory protections against cost overruns. Why is the Department of Energy (DOE) proposing to move this funding between accounts? Is there a concern about potential overruns?

A1. The President's fiscal year 2006 budget proposes to rescind $257 million from the Clean Coal account and advance-appropriate the same amount to FutureGen in the FY 2007 budget. This proposal would move remaining prior-year funds from terminated clean coal demonstration projects to an account specific to FutureGen, a large-scale research project. Forward-funding the FutureGen project for several years is an indication of the government's serious commitment to the FutureGen project. With regard to potential cost overruns, it is our intent to exercise tight controls over cost and schedules using strong management principles and practices in keeping with the general project management guidelines of the Department.

Q2. The Office of Fossil Energy has chosen a unique management structure for the FutureGen project. As I understand it, the structure would create a private-sector consortium to manage both oversight and operations. Is the proposed management approach to large demonstration projects such as FutureGen the right mechanism to ensure efficient operation and oversight of federally-funded projects? Please explain the role of the project integrator and how that approach is better for public purposes. What is the liability of the Federal Government in the event that the private-sector partners walk away from the project before the demonstration is complete?

A2. The Department of Energy has chosen a project structure for FutureGen that is not unique, but one which has been employed with similar projects that have been cost-shared between government and industry. The implementation of the FutureGen project through a cooperative agreement with an industry consortium was one of many methods studied to determine how best to proceed with meeting the need for a zero emission coal-based power plant. After all methods were thoroughly studied, DOE concluded that a cooperative agreement with an industry consortium was the preferred and most efficient mechanism available to ensure that the goals of the FutureGen research project would be met. One of the chief goals of the FutureGen project is replication of zero emission clean coal technology once the technical feasibility and economic viability of the project has been proven. For this reason, significant participation from the coal utilities and technology providers who we expect to carry out those replications is essential, and partnering closely with these private-sector entities is appropriate. The project will be managed with distinct budget periods that limit the liability of all parties for each period and will adhere to the Department's comprehensive project management guidelines for major projects regarding Critical Decision approvals by the Department's energy systems acquisition review board. While any partner can discontinue participation at the end of a budget period, currently the liability of the Federal Government would be limited to the monies invested up to that point and offset by the government's ownership of any residual assets to which it was entitled.

Q3. The FY06 budget request indicates that over 65 percent of the cost of the FutureGen project would come from the Federal Government ($620 million of the $950 million). The Energy Policy Act of 1992 *requires that demonstration programs receive no more than 50 percent of their funding from federal sources. Does the proposed budget for FutureGen follow the requirements in law that demonstration projects be costs shared, with industry contributing a minimum of fifty percent of the cost of the project?*

A3. The FutureGen Project is an advanced demonstration project that will attempt to integrate cutting-edge technologies and components, some of which are not currently ready for full-scale demonstration. The approximate overall cost-share percentages are 26 percent from industry, 65 percent from the government, and nine percent from International contributions. However, not all portions of the project will be cost shared at the same level. Consistent with the Fiscal Year 2004 and 2005

Appropriations language, the Federal Government will maintain a 50 percent cost-share from non-federal sources on any component of the project that would be considered as demonstration. Less will be sought for portions with technology not ready for full-scale demonstration, such as carbon sequestration.

Q4. Natural gas prices are at all-time highs, and the chemical industry has been cutting production in the U.S. in response to those prices. Gasification of coal creates a synthetic mix of gases, often called syngas, which can be used in many of the same processes as natural gas. If large-scale gasification were in place in the U.S. today, coal could serve as a stabilizing force on natural gas prices. What is DOE doing to promote the use of coal gasification as a substitute for natural gas?

A4. The Department of Energy's clean coal research program, in partnership with U.S. industry, is conducting research, development, and demonstration activities to improve the performance and reduce the costs of advanced gasification systems. Research on these advanced gasification technologies is aimed at low-cost, reliable methods of gasifying a variety of coals into a synthesis gas (syngas) that can be used in an integrated gasification system to co-produce electricity, high value chemicals and fuels (hydrogen), or converting the syngas into methane as an alternative fuel to natural gas. For example, relatively inexpensive domestic feedstocks such as lignite coal can be gasified to produce a synthetic gas. This synthetic methane as an alternative to natural gas is currently being produced by the Dakota Gasification plant in Beulah, North Dakota.

The coal gasification program includes research on low-cost, fuel-flexible, longer life refractory materials; advanced oxygen membrane technology with lower costs and improved efficiency; low-cost, ultra-clean gas stream cleanup systems; designs for gasifiers that operate more efficiently on low rank coals; and advanced catalysts for producing hydrogen and synthesis gas in shift reactors. These activities will enable us to use coal to produce power, from efficient hydrogen turbines, and high value fuel and chemical products. For the longer-term, the coal gasification program is a key element in the effort to develop advanced technologies for efficient, near-zero atmospheric emissions coal plants that are fuel flexible, and affordable.

Question submitted by Representative Ralph M. Hall

Q1. I am concerned about the future of manufacturing in the U.S. As you well know, our natural gas prices are the highest in the world and are beginning to price U.S. companies out of global markets. I would like to know what DOE is doing to stimulate new energy technologies. I am told by business people in my district that coal gasification technology holds great promise. They tell me lignite, mined in my district, can be converted in to a form of gas that can be used to make chemicals, electricity, and even ultra-clean form of diesel fuel. It strikes me that gasification may have the potential to save natural gas and U.S. jobs. What is DOE doing to help make this technological promise a reality?

A1. The Department of Energy, in partnership with U.S. industry, is conducting research, development, and demonstration activities to improve the performance and reduce the costs of advanced systems that produce power, fuels (hydrogen), and chemicals from coal and alternative fuels (biomass). The Coal Gasification Program is a key element of efforts to develop advanced technologies for efficient, near-zero atmospheric emissions coal plants that are fuel flexible, and affordable.

There are a number of gasifiers that have been designed to accommodate a variety of specific coals (and other feedstock) including low-rank coals such as lignite. Lignite is a good example of a relatively inexpensive domestic feedstock that can be gasified to produce a synthetic gas. This synthetic methane as an alternative to natural gas is currently being produced by the Dakota Gasification plant in Buelah, North Dakota.

The Gasification Program includes research on low-cost, fuel-flexible, longer life refractory materials; advanced oxygen membrane technology with lower costs and improved efficiency; low-cost, ultra-clean gas stream cleanup systems; designs for gasifiers that operate more efficiently on low rank coals; and advanced catalysts for producing hydrogen and synthesis gas in shift reactors. These activities will enable us to use coal to produce power, from efficient hydrogen turbines, and high value fuel and chemical products from coal.

Overall, the research that we are pursuing is focused on making gasification more competitive by developing advanced technologies that will lower its capital cost and reduce risk, and position coal gasification to be compatible with the capture of car-

bon dioxide for the future. It is anticipated that this effort could improve the competitiveness of gasification systems being marketed by major vendors today.

Question submitted by Representative Bob Inglis

Q1. The Administration's budget request for Distributed Generation—Fuel Cells provides that funding in the Solid State Energy Conversion Alliance (SECA) program will be used to "continue MW-scale SECA fuel cell and fuel cell hybrids work." What activities in this area do you envision in FY06, and what is the Department's plan for this program beyond FY06?

A1. The current strategy is to develop clean high efficiency fossil fueled power plants: Immediate near-term (2006–2007)—validate successful Solid State Energy Conversion Alliance (SECA) Phase I achievements and initiate Phase II SECA low-cost, 3–10 kilowatt solid-state fuel cell modules for distributed and auxiliary power unit applications. Validation of target achievements will be done via testing of the first prototype fuel cells to confirm the first plateau of performance (current density, hours of operation) and analyzing the design and cost reduction potential using the system components. If the fuel cell prototype passes the first "gate" it will qualify for a second phase development aimed at further performance improvements and cost reduction designs that will be tested and analyzed at the end of the second phase. Mid-term (2007–2010)—develop and test SECA fuel cell prototype modules capable of manufacture of $400 per kilowatt (a ten-fold reduction from fuel cells available in 2000); and Long-term (2010–2015)—scale-up and demonstrate the critical high risk technology advancements which will permit U.S. industry to establish commercial availability of advanced, low-cost, ultra-high efficiency, fuel flexible, integrated fuel cell and fuel cell/turbine hybrids systems for synfuel and hydrogen-based plants. Fuel cell systems have specifically identified goals which coincide with coal-based and other fuel-flexible zero emissions power modules and concepts in the 2010 to 2015 time frame.

Questions submitted by Representative Michael M. Honda

Q1. DOE recently released a series of reports indicating the potential to recover 43 billion barrels of additional domestic oil through the use of carbon dioxide-enhanced oil recovery. This is a technology that has received considerable federal research attention in the past and the release suggested the importance of additional research to apply the technology in these other areas.

- *So, faced with the opportunity to produce an additional 43 billion barrels of oil in the United States, as I understand the Administration's budget request, why does the Administration recommend that this research be terminated?*

A1. The decision to terminate the oil and gas research programs reflects a strategic assessment of the programs compared to other DOE programs. This is in line with our commitment to deliver results for the American taxpayer.

Much of the Department's oil and natural gas research is jointly funded by industry and the government. It was determined that the industry has the capacity to pursue this research, especially in light of the current strong economic performance of the industry.

Q2. In 2003, the Secretary's advisory group—the National Petroleum Council—looked at natural gas supply and demand challenges over the next 25 years. The Supply Task Group recommended that from 2003 to 2010, public money from government agencies such as the DOE or Joint Industry Partners made up of both government and industry partners should continue doing the research and technology development in gas hydrates. Under the Administration's budget request, there would be no federal money available to conduct further research or joint projects envisioned by these experts—a group chaired by a major oil company.

- *How does the Administration's budget request square with the advice of its own Petroleum Council?*

A2. The Administration believes that the Energy Bill requested by the President will stimulate research and technology development by industry. In addition, recent high oil and gas prices provide an added incentive to substantially increase private R&D investments in gas hydrates.

Q3. It is my understanding that the DOE oil and natural gas research and development (R&D) are largely cost shared in about equal amounts. Many of the con-

tributors are universities where the projects are used to fund graduate student in petroleum engineering or petroleum geology programs. Separately, the Department of Labor has initiated an effort to address the labor challenges in the oil and natural gas exploration and production industry—including both rig workers and engineers and geologists.

- *Did the Administration solicit comments from these universities funding partners on the consequences of terminating these R&D functions and on their ability to maintain their engineering and geology programs without continued DEO funding?*
- *What do you believe the consequences will be if these programs are terminated?*

A3. Budget discipline necessitated close scrutiny of all Fossil Energy programs, using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. University funding partners were not consulted on this strategic decision.

Much of the Department's oil and natural gas research is jointly funded by industry and the government. It was determined that the industry has the capacity to pursue this research, especially in light of the current strong economic performance of the industry.

Research Capabilities of Integrated Oil Companies

Q4. I'm told that only companies with significant research capabilities are the major integrated oil companies.

- *Can you tell us how much of current U.S. enhance oil production—outside of Alaska—comes from the companies that have large research capabilities?*
- *How likely is it that these companies would direct research to these areas?*
- *If they were to conduct the research, how likely is it that these companies would share the technology with other enhanced oil producers?*

A4. An analysis of industry R&D spending (1997–2000), reported by the Interstate Oil and Gas Compact Commission, showed that the oil and gas service industry spent $631 million per year on R&D, about 17 percent higher than the spending of energy producers ($540 million per year, 1997–2000). The Department expects the service industry to continue to provide technological innovations for use by major and independent producers, including companies engaging in enhanced oil production.

Questions submitted by Representative Jerry F. Costello

$2 Billion Commitment to Coal

Q1. The DOE is currently conducting a ten-year, $2.0 billion program, the President's "Clean Coal Power Initiative" (CCPI) which is intended to cost share with the industry the demonstration of clean coal technologies that are "ready to go" today. DOE requested $50 million for the CCPI program in FY06. Is the DOE fully committed to funding the CCPI program at $2 billion over 10 years?

A1. The Fiscal Year 2006 budget supports the Department's continuing effort to fulfill President Bush's 10-year $2 billion commitment to clean coal research with funding for the President's Coal Research Initiative (CRI) of $286 million, a $13 million increase over the 2005 enacted level. The 2006 Budget brings the total requested funding for clean coal research to $1.6 billion over five years, on pace to exceed the President's ten-year pledge by more than 50 percent.

The President's Coal Research Initiative is made up of the Clean Coal Power Initiative (CCPI) as well as FutureGen, and Coal Technology Research and Development (which includes Sequestration, Fuels, Emissions Control, Coal Gasification, Turbines and Advanced Research and Development).

Q2. The DOE is currently conducting a ten-year, $2.0 billion program, the President's "clean coal power initiative" (CCPI) which is intended to cost share with industry the demonstration of clean coal technologies that are "ready to go" today. DOE requested $50 million for the CCPI program in FY06.

If there is to be a third CCPI solicitation in FY07, will the Department be requesting an additional $250 million for FY07 to get the total dollars in the third solicitation to the $300 million level, which has been the amount in each of the first two solicitations?

A2. The Administration's FY 2007 budget has not been finalized yet. The Department is in the initial planning stages for CCPI Round 3, which will demonstrate advanced technologies currently being developed, such as integrated advanced clean-up technologies that include mercury controls, and advanced next generation power technologies that are carbon sequestration compatible. Specific goals and a time-frame for Round 3 have not been determined at this time and will depend on technology developments and future budgetary considerations.

Q3. The DOE is currently conducting a ten year, $2.0 billion program, the President's "clean coal power initiative" (CCPI) which is intended to cost share with industry the demonstration of clean coal technologies that are "ready to go" today. DOE requested $50 million for the CCPI program in FY06.

Will the funds appropriated for this demonstration program be used strictly for the CCPI program or will it be split with the FutureGen Initiative?

A3. The funds appropriated for the Clean Coal Power Initiative demonstration program will be used strictly for CCPI demonstration projects. The FutureGen Initiative is funded directly from its own budget line item. In the Administration's FY 2006 Request, the Clean Coal Power Initiative demonstrations are budgeted at $50 million, and the FutureGen project is budgeted at $18 million, with a request for advanced appropriation of $257 million to be used for FutureGen in FY 2007 and beyond.

Question submitted by Representative Al Green

Q1. I notice in your testimony that there has been a strong focus, in terms of funding, on the President's Initiatives. How much of a role does that play in your request for the funding of activities, and have you found any major divergent visions between your particular sectors and the Administration's initiatives?

A1. The Department of Energy is an executive branch agency. We are responsible for carrying out the President's Initiatives. In formulating the budget, the Administration has to balance many priorities. The funding requested for these programs is consistent with the President's overall management goals. There are no major divergent visions between the Department and the Administration.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Robert Shane Johnson, Deputy Director for Technology, Office of Nuclear Energy, Science, and Technology, Department of Energy, Washington, DC

Questions submitted by Chairman Judy Biggert

Impact of Idaho National Laboratory Reorganization on R&D Programs

Q1. How will the reorganization of the Idaho laboratory complex affect the Department of Energy's (DOE'S) overall nuclear energy research and development (R&D) program? What role will other national laboratories with significant nuclear expertise, such as Argonne National Laboratory, play in nuclear energy R&D after Idaho National Laboratory begins operations? Does the Department plan to phase out nuclear research at other laboratories?

A1. The reorganization of the Idaho complex is intended to facilitate and strengthen the Department's long-term vision for the Idaho National Laboratory (INL) to become the Nation's leading center of excellence for nuclear energy research and development (R&D). INL's focus on the development of advanced nuclear technologies will provide significant improvements in sustainability, economic, safety and reliability, and non-proliferation and resistance to attack. However, the Department recognizes that many other national laboratories have well-established areas of expertise in multiple nuclear technology disciplines, and some laboratories have unique test facilities. DOE intends to continue to use these valuable assets in moving ahead with our nuclear energy R&D programs.

Background:

- There are three advanced nuclear energy research programs within the Office of Nuclear Energy, Science and Technology that fund R&D at the national laboratories: Generation IV Nuclear Energy Systems Initiative (Generation IV), Nuclear Hydrogen Initiative (NHI), and Advanced Fuel Cycle Initiative (AFCI).
- The national laboratories engaged in nuclear energy R&D and the programs they support are listed below:
  - Argonne National Laboratory—East: Generation IV, NHI, AFCI
  - Argonne National Laboratory—West: Generation IV, NHI, AFCI
  - Brookhaven National Laboratory—AFCI
  - Idaho National Engineering and Environmental Laboratory—Generation IV, NHI, AFCI
  - Los Alamos National Laboratory—AFCI
  - Lawrence Livermore National Laboratory—Generation IV, AFCI
  - Oak Ridge National Laboratory—Generation IV, NHI, AFCI
  - Pacific Northwest National Laboratory—AFCI
  - Sandia National Laboratories—Generation IV, NHI, AFCI
  - Savannah River National Laboratory—NHI, AFCI

Questions submitted by Representative Michael M. Honda

Q1. In the 1970s and early 1980s, the domestic nuclear industry provided virtually 100 percent of the design, construction, fabrication, fuel and other needs of our nuclear infrastructure.

- *What percent of uranium fueling our reactors comes from the U.S. mines at present?*
- *How many of the original domestic reactor design companies are left?*
- *Is it indeed the case that other countries such as France, Britain, Russia and Japan either own and/or heavily subsidize their own nuclear industry?*
- *Under these circumstances how difficult is it for domestic companies to compete internationally or even within our own borders for nuclear business?*
- *Does DOE have any policy taking action to support the domestic nuclear supply and technology industry?*

A1. According to the Energy Information Administration, U.S. uranium production from mines in 2004 was 2.5 million pounds, or about five percent of the 51 million pounds uranium equivalent contained in fuel assemblies loaded into U.S. reactors during 2004. Of the five original reactor vendors in the United States (Westinghouse, General Electric, Babcock & Wilcox, Combustion Engineering and General Atomics), only Combustion Engineering no longer remains. General Electric and Westinghouse are focused on light water reactor technology, while General Atomics is working on gas-cooled reactors and Babcock & Wilcox offers nuclear power equipment. Westinghouse's nuclear business is located in the U.S. but is wholly owned by British Nuclear Fuels, Limited, a company based in the United Kingdom.

Governments own all or a majority of the nuclear industries in France, Britain and Russia, although attempts to privatize companies are in early stages in France and Britain. Private Japanese companies control most of the reactor design and nuclear fuel industries in Japan. The governments of France, Japan, and Russia heavily subsidize the commercial nuclear technology and fuel research and development activities, and support their domestic company's nuclear technology marketing and sales to other countries. This type of support puts U.S.-based reactor vendors at a competitive disadvantage when competing globally for the sale of new nuclear power plants. Uranium mining, conversion, and enrichment are more of a commodity business than designing and engineering reactors.

Given the importance of this industry, however, the U.S. has provided strong support for the domestic nuclear supply and technology industry. The Department initiated the Nuclear Power 2010 program, in part, to demonstrate the untested federal licensing processes for siting, building, and operating new nuclear power plants. Additionally, the Nuclear Power 2010 program supports reactor vendor activities to successfully accomplish the Nuclear Regulatory Commission certification and completion of "first-of-a-kind" engineering of their proposed advanced light water reactor designs. The Department is supporting the development and certification of the General Electric Economic Simplified Boiling Water Reactor (ESBWR) and the Westinghouse Advanced Pressurized Water Reactor (AP–1000) reactor designs in a 50–50 cost-shared partnership with the nuclear industry.

In addition, the recently passed Energy Bill included a proposal by the President to offer risk insurance for new nuclear power plant construction. Providing this risk insurance as well as significant support for nuclear energy research and development programs has helped to eliminate barriers facing the nuclear energy industry and will help make U.S. companies even more competitive with foreign suppliers.

Question submitted by Representative Al Green

Q1. I notice in your testimony that there has been a strong focus, in terms of funding, on the President's initiatives.

How much of a role does that play in your requests for the funding of activities, and have you found any major divergent visions between your particular sector and the Administration's initiatives?

A1. The Administration's initiatives play a major role in the development of the Department's budget request. Following publication of the "National Energy Policy," the Department developed a Strategic Plan that defines its mission and goals for accomplishing that mission. The Office of Nuclear Energy, Science and Technology programs and budget requests support the Department's goal to protect our national and economic security by promoting a diverse supply of reliable, affordable, and emissions-free energy.

The "National Energy Policy" and the Administration's initiatives for nuclear energy are aligned with the Department's programs to support the development of new nuclear generation technologies that provide significant improvements in sustainability, economics, safety and reliability, and nonproliferation. Specifically, the Generation IV Nuclear Energy Systems Initiative establishes a basis for expansive cooperation with our international partners to develop advanced reactor and fuel cycle systems that represent a significant leap in economic performance, safety, and proliferation-resistance. Through the Advanced Fuel Cycle Initiative, the Department seeks to develop advanced, proliferation resistant nuclear fuel technologies that maximize the energy produced from nuclear fuel while minimizing wastes. The Nuclear Power 2010 program supports intermediate-term research, technology development and demonstration activities that advance the "National Energy Policy" goals for enhancing long-term U.S. energy independence and reliability and expanding the contribution of nuclear power to the Nation's energy portfolio. In addition, the Nuclear Hydrogen Initiative will develop advanced technologies that can be used in tandem with advanced nuclear energy plants to generate economic, commercial

quantities of hydrogen to support a sustainable, clean energy future for the United States.

The Department worked closely with Congress on the development of the "National Energy Policy." The nuclear titles of the policy were crafted in conjunction with experts from the Department and thus are supportive and complementary to NE's vision. Additionally, as noted earlier, the Department's vision for nuclear energy, science, and technology is fully aligned with that of the Administration.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Kevin M. Kolevar, Director of the Office of Electricity Delivery and Energy Reliability, Department of Energy, Washington, DC

Question submitted by Chairman Judy Biggert

Q1. What is the rationale for the proposed reduction in the Fiscal Year 2006 budget for energy storage, given the likely contribution to improving grid stability and enabling the connecting of intermittent sources (such as wind) to the grid?

A1. The Fiscal Year (FY) 2006 budget request for the Office of Electricity Delivery and Energy Reliability (OE), in line with Presidential priorities and budget reductions, has been reduced by $5.876 million from the FY05 request. Storage was one of several R&D programs that, in light of budget constraints, were reduced in order to fund higher priority activities. The FY06 budget request will provide funding support for those activities which the Administration believes are critical to DOE's mission.

Questions submitted by Representative Michael M. Honda

Q1. In your testimony you cite military propulsion and directed energy weapons applications as examples of the application of high temperature superconductivity wire developed through Department of Energy (DOE) research.

How quickly can we expect to see this technology in electric transmission and distribution systems? What barriers need to be overcome in order for this research to be ready for commercializing other non-military applications?

A1. We are beginning to see the impacts of high temperature superconductivity technology on the electricity grid today. The FY 2006 Budget request supports demonstrations, in partnership with electric utilities and equipment manufacturers, of first-of-a-kind equipment prototypes in operation on the grid. For example, three complete, integrated systems that demonstrate different aspects of superconducting cables are now being developed in partnership with American Electric Power, Long Island Power Authority and National Grid (Niagara Mohawk) for planned operation and testing on electric grids in Ohio and New York. The time to market will be accelerated by this approach which provides utilities direct experience with installation and operation of superconducting equipment as well as gaining the advantages of their collaboration in designing equipment which will meet their needs and requirements. We are continuing research that improves the performance and potential cost of future high temperature superconductivity grid equipment. This includes technology research into advanced wire materials and processes to enable production of long lengths of cost-competitive, superconducting wire.

Q2a. Describe for us the role of the electric utilities in the development with DOE of the real-time monitoring and control software tools and system operating models that are the core of your Transmission Reliability and distribution research and development (R&D) programs.

What problems, if any, has DOE encountered in the development of the technologies and procedures for the Transmission Reliability program?

A2a. With respect to electric transmission, reliability is enhanced when additional lines are added to the grid, proper maintenance occurs in a timely manner, and when grid operators are able to make adjustments, in real-time, to address fluctuations in system conditions, particularly during periods of peak demand. Real time grid reliability management is a key focus for the Transmission Reliability Program, and several recent accomplishments designed to help operators recognize, analyze and respond to system anomalies and predict performance under various circumstances demonstrate this commitment. In fact, several analysts believe that the tools being developed and deployed, including VAR-Voltage Management Tool, Area Control Error (ACE)-Frequency Real-Time Monitoring System, and Synchronized Phasor Measurement Tools, could have limited the spread and may have prevented the August 14, 2003, blackout altogether had they been in place in this region. Working with the Consortium for Electric Reliability Technology Solutions (CERTS) and industry partners, including Independent System Operators, DOE plans to continue the research, development and deployment of these monitoring and visualization tools, enabling the region-wide sharing of real time information from measurement technologies.

Q2b. What technology barriers to the integration of distributed energy resources into electric distribution systems have you encountered?

A2b. The mission of the Electric Distribution Program (which refers collectively to the Electric Distribution Program and the GridWise Initiative) is to transform today's electric distribution infrastructure for increased affordability, reliability, security, and resilience, through integration of advanced communications, information, sensors, controls, and distributed energy resources (DER) with electric power systems. The central strategy employed by the Program to achieve its mission is a comprehensive set of R&D partnerships involving other federal programs, State programs, and the private sector.

One of the challenges that distributed energy resources encountered as they integrated with the electric system was the need for consistent, objective, yet technically sound, connection requirements that addressed both the operational needs of the distributed energy resource, but also the safety concerns of the connecting utility. Thus, the Electric Distribution Program is partnering with the Institute of Electrical and Electronics Engineers (IEEE) for the development of uniform interconnection standards, IEEE 1547. Organizational and technical support is also being provided to develop international standards via the International Electrotechnical Commission Technical Committee 8 (IEC TC 8), System Aspects of Electrical Energy Supply.

Q2c. What science or technical breakthroughs does DOE expect to make with the storage program that will enable significant quantities of power to be available to increase grid reliability and mitigate congestion problems?

A2c. Breakthroughs that reduce the costs of electricity storage systems could potentially drive changes in the design and operation of the electric power system. Peak load problems could be reduced, electrical stability could be improved, and power quality disturbances could be eliminated. Storage can be applied at the power plant, in support of the transmission system, at various points in the distribution system, and on particular appliances and equipment on the customer's side of the meter. The Energy Storage Program performs research and development for storage technologies and systems that incorporate a broad technology base consisting of batteries (both conventional and advanced), flywheels, high-energy density capacitors, superconducting magnetic energy storage (SMES), power electronics, and control systems.

Q3. What are the three most important issues that DOE and electric power industry face in modernizing the existing bulk power transmission system?

A3. The overarching challenges are to strengthen the flow of investment capital into grid-related improvements, and to focus that flow on the changes that are most urgently needed. To accomplish this, three critical actions are needed:

- The U.S. Congress needs to enact legislation with mandatory and enforceable reliability standards;
- Collaborative efforts are needed at the regional level to determine what the design characteristics of the region's next-generation grid should be; and
- While FERC has primary regulatory responsibility for the transmission grid at the federal level, DOE can work with regional organizations and groups of states to facilitate regional transmission planning to identify the issues (both technical and policy) that need to be addressed and resolved in order for transmission grid investment to occur. Many institutional questions need to be addressed at the regional level, such as how the costs of new facilities will be allocated across a multi-state region, how to streamline the processes for determining whether a specific facility is needed, and how regional siting protocols are to work.

Questions submitted by Representative Al Green

Q1. Following the Northeastern energy grid blackout in 2003, national attention was focused on enhancing and securing our electrical grid systems. It is my understanding that the Office of Electricity Delivery and Energy Reliability (OE) is the lead in modernizing such efforts with a request of $95.6 million for various activities.

Can you elaborate more specifically on two of the initiatives, the GridWise and GridWorks initiatives as well as give me an estimate of the budget for the two?

A1. These two new activities were developed to better integrate advancing power technologies into the electric delivery system in order to achieve increased reliability and security. GridWise develops real time controls, advanced communications and information software technologies for electric distribution and end use. GridWorks develops advanced hardware technologies, including cables and conductors, substation and protective systems, power electronics, and sensors.

If we compare the President's FY 2005 request to the FY 2006 request, the total amount requested for GridWorks and GridWise is the same (i.e., $10.5 million). This reflects the Administration's continued commitment to these programs, and their potential contribution to the reliability of the electric grid.

Q2. In the hearing you spoke of transferring technologies from the research and development phase to actual implementation in the grid system. Could you perhaps discuss what you feel a time line for tech transfer should be, how the OE budget should change when it is time for such implementation, and what sort of delays we might see from the end of the development phase to the beginning of the implementation phase?

A2. The time line for implementation strongly depends on the technology. Research in high temperature superconductivity, for example, has been occurring for over a decade. However, it is important that the user, in our case the utility, is involved in the project during all phases—research and development, as well as demonstration. This approach provides utilities with direct experience with installation and operation of equipment as well as gaining the advantages of their collaboration in designing equipment which will meet their needs and requirements. Often, the more that the utility has been engaged in the project during the early stages, the easier it is to transition from the development phase to the demonstration stage and finally to commercial deployment. This is because the utility's technological needs have been taken into account, there is an existing familiarity with the technology by the user, and thus the potential risks of integrating the new technologies into their system are better understood.

Q3. I notice in your testimony that there has been a strong focus, in terms of funding, on the President's initiatives. How much of a role does that play in your request for the funding of activities, and have you found any major divergent visions between your particular sectors and the Administration's initiatives?

A3. The FY 2006 budget request for the Office of Electricity Delivery and Energy Reliability will provide funding support for activities which the Administration and DOE believe will ensure electricity reliability and energy critical infrastructure protection.